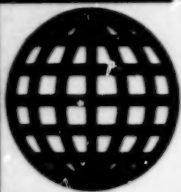


JPRS-TND-89-003
6 FEBRUARY 1989



**FOREIGN
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JPRS Report

Nuclear Developments

Nuclear Developments

JPRS-TND-89-003

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NORTH KOREA

U.S., ROK Suspect Nuclear Plant Planned
SK2701132589 Seoul Television Service in Korean
1200 GMT 27 Jan 89

[Text] The FAR EASTERN ECONOMIC REVIEW in Hong Kong today reported that the officials of the ROK and the United States are concerned about the possibility of North Korea's building a nuclear-fuel reprocessing plant—the first stage in the production of nuclear weapons—beside the nuclear power plant near Pyongyang. This magazine reported that, although a U.S. satellite camera detected these facilities a few months ago, the United States is reluctant to disclose the information because it cannot prove North Korea plans to build such a plant.

SOUTH KOREA

USSR Offers Nuclear Fuel to ROK
SK2701103589 Seoul YONHAP in English
1028 GMT 27 Jan 89

[Text] The Soviet Union has offered to supply nuclear fuel to South Korea, informed government sources said Friday.

Sources at the Energy and Resources Ministry said the Soviet Union asked senior South Korean Government officials who visited Moscow late last year to import its low enrichment uranium.

"Although the Soviet uranium is inexpensive and we have no problems with international regulations in importing the nuclear fuel, we have not given clear response to the Soviet offer because it is a matter to be studied at policy-level," a ranking Energy and Resources Ministry official said.

South Korea, member of the International Atomic Energy Agency, already joined an international agreement on nuclear safety in 1975.

The official, speaking on condition of anonymity, added that the government, however, is considering importing the Soviet uranium in a long-term point of view.

"Because we have already secured nuclear fuel needed until 1995 under long-term contracts with the United States and France, we don't have to secure additional supply sources. In the long run, however, it is necessary to consider importing the Soviet uranium," the official said.

As the anti-nuclear movement is expanding worldwide, the Soviet Union, which have invested billions of U.S. dollars in building a uranium processing plant, is selling its low enrichment uranium to Finland and France at far lower prices than the U.S. products to keep its plant in operation, the sources said.

South Korea, which is yet to have uranium processing facilities of its own, imports refined uranium ore from Australia and Canada and has it processed in the United States and France to obtain fuels to be used at its nuclear power plants.

President Urges Safety Steps for Nuclear Power Plants

SK2701011489 Seoul THE KOREA HERALD
in English 27 Jan 89 p 2

[Text] President No Tae-u yesterday ordered a thorough review of safety measures at atomic power stations.

A nuclear accident would be devastating. No said after being briefed by Yi Sang-hui, minister of science and technology, on programs for this year.

No instructed Yi to work out a longterm plan for development of science and technology to win international competition in the 21st century.

He further told Yi to make joint efforts with academic, business and research institutes in developing new industrial technologies.

No said priority should be given to fostering scientists and engineers to put Korea on the list of advanced nations.

In the afternoon, No was briefed by Minister of Communications Choe Yong-chol on the nation's communications policy for 1989.

No told Choe to take positive steps for the U.S. pressure for the opening of the Korean telecommunications market to avoid any trade conflict.

Saying that the nation should fully open its telecommunications market soon, No instructed Choe to help the communications industry to sharpen its competitive edge.

He also told Choe to push ahead with a program to bring the state-run Korea Telecommunications Authority under private management this year.

ARGENTINA

Investments in Nuclear Plants Termed 'Priority' *PY1801024189 Buenos Aires TELAM in Spanish 1745 GMT 18 Jan 89*

[Text] The executive branch has declared all CNEA contracts and investments in the national power grid to overcome the present situation "urgent and of priority." The decree in question refers to all CNEA efforts to maintain the Embalse nuclear plant in operation and to speed up the repairs at Atucha I power plant.

The decision was made formal by the signing of Decree 52 at Government House this afternoon. The decree also said that all CNEA imports for these two nuclear plants will be exempted from the requirements of Law 22763 if, at the time the goods to be imported are ready for shipping, no Argentine ships are available for transportation.

The decree is signed by President Raul Alfonsin, Economy Minister Juan Sourrouille, and Finance Secretary Mario Brodersohn.

The executive branch considered that the CNEA should also benefit from the exemptions established by Executive Decree 1927 of 29 December 1988, which established a series of exemptions and special proceedings to help implement specific programs to increase the production of electric energy because the CNEA supplies energy through the Atucha I and Embalse nuclear plants.

BRAZIL

FRG Deputy Criticizes Nuclear Accord *51002041b Sao Paulo FOLHA DE SAO PAULO in Portuguese 7 Dec 88 p C-3*

[Text] Deputy Willi Hoss, 59, of West Germany's Green Party, arrived Saturday in Rio and spoke to FOLHA yesterday in an exclusive interview, where he stated that Brazil should rescind the nuclear agreement signed with his country 13 years ago. The agreement, "a scandal" according to Willi, resulted in the purchase of the Angra 2 plant (in construction) and the Angra 3 plant (with ground barely broken), both in Angra dos Reis (154 km south of Rio's coast), among other undertakings. The Brazilian government owes \$4 billion (around Cz\$700 billion) as a result of this agreement.

In Willi Hoss' opinion, instead of paying Germany Brazil should employ that money in "projects of basic need, such as providing food and public housing, constructing schools, providing health services in the slums, improving transport, and generating employment." The German deputy said that another alternative would be to target the money for the development of research into alternative sources of energy production, such as solar,

which are already being studied by some countries. To Willi "it is important, however, that the budget be controlled by authentically popular organizations."

Willi Hoss said that "if there were not great resistance among the people and even among some politicians of the ruling party in Germany," his country would "certainly agree" to the World Bank (IBRD) approving a loan on the order of \$500 million (around Cz\$306 billion) for the Brazilian electricity sector. The loan's approval has been disputed because the nuclear plants comprise part of the electricity sector and the IBRD refuses to finance nuclear projects. "We do not want Brazil to be denied the loan," he said.

According to Willi, the German Green Party believes that Brazil wants to produce an atom bomb. "We have information that the military is taking advantage of the transfer of technology to have access to the bomb, which the Argentine military is also doing," he said. The deputy, who will be in Brazil until the 22d of this month, brought an invitation on the part of his party for Angra Mayor-Elect Nerobis Nagal (PT) to visit nuclear facilities in Germany.

USP Research in Nuclear Fusion Discussed *51002041a Sao Paulo O ESTADO DE SAO PAULO in Portuguese 8 Dec 88 p 13*

[Text] The Physics Institute of the University of Sao Paulo has just obtained the resources it needed to build a new plasma physics laboratory, part of an ambitious international program to master electrical energy production technology through the nuclear fusion process. In 4 years the equipment to contain the plasma will be completed, capable of retaining gases for 1 second, which represents an advance over the current stage: Until now, USP researchers have only been able to contain plasma for 0.006 second.

The apparatus necessary for the research will cost about Cz\$2.5 billion, which will be financed by the Interamerican Development Bank (IDB) and the National Plasma Physics Program. "It is a research project performed in conjunction with other countries, the goal of which is to demonstrate the scientific feasibility of thermoelectric energy production through fusion," explains physicist Ivan Cunha Nascimento, director of the Physics Institute. Scientists calculate an annual expenditure of \$1 billion throughout the entire world in research of this type.

Current nuclear plants release energy in reactions by the breakdown (fission) of the atomic nuclei of uranium and thorium. When the heat is released, the necessary gain in energy occurs to produce electricity. The fusion process is aimed at achieving the same objective, with an advantage: It is cleaner and safer, in the opinion of physicist Ibero Caldas, of the USP Physics Laboratory. "There will be no loss of control of the reactor," he says.

For the fusion necessary for energy production to occur, the nuclei of the atoms must be quite close together. When they possess a positive electrical charge, they can overcome the force of repulsion tending to separate them. For that reason hydrogen isotopes, which have a positive charge, are the most appropriate to use as fuel in fusion reactors.

Fusion is the same process as used by the sun to generate electricity. In the stars, the fuel is common hydrogen, but in the mathematical models simulated in the laboratory on machines that are miniatures of real reactors, thermonuclear fusion will be achieved through the perfect approximation of light nuclei of heavy hydrogen (deuterium) and tritium. Deuterium is found in the water and the tritium may be obtained in lithium mineral deposits. Plasma physics research has been performed at the USP since 1980.

New Method Produces Controversy

An alternative method for achieving nuclear fusion that appears promising has just generated an academic controversy in the United States. Instead of using powerful magnetic fields to heat, pressurize and compress two hydrogen isotopes, as is usually attempted throughout the world, the alternative method consists of bombarding minuscule hydrogen spheres with a battery of lasers.

One of the scientists who participated in the project, physicist Leonard Mascheroni, who supervised research in the Lawrence Livermore and Los Alamos laboratories, and who was replaced at the beginning of this year, states that the American government has embarked on a project that will cost \$2 billion, based on an incorrect estimate of the power of the lasers needed to ignite the fusion reaction. The physicist, replaced for administrative reasons, is calling for batteries of lasers of 100 million joules of energy, 10 times more than that calculated by the government team. One joule is approximately equal to the energy released by a common flash bulb during 1 second.

Mascheroni, who argued for more powerful lasers before his replacement, accuses the government of having already noted the error in the calculations, but of keeping it a secret. In addition to the rectification of the calculations, the physicist demands to return to his position on the project.

USP To Begin Production of Tokamak-2 Reactor
51002043a Sao Paulo FOLHA DE SAO PAULO
in Portuguese 10 Dec 88 p C-12

[Article by Carlos Antonio Rahal]

[Text] The Sao Paulo University Physics Institute has designed a machine that will contribute to the development of a source of nonpolluting and inexhaustible

energy. Construction will begin next year. The machine is called Tokamak-2, and it is a plasma-confining device in which nuclear fusion research will be carried out. World nuclear fusion research, in which Brazil will now be able to participate more fully, is aimed at developing a commercial fusion reactor for the production of "clean" electric power.

The Sao Paulo University Physics Institute (IFUSP) already has a Tokamak. Since 1978, the year in which it began operating, studies based on that Tokamak have resulted in about 30 doctoral and master's theses, according to the institute's director, Ivan Cunha Nascimento. "Our Tokamak has already done a great deal of work, but we need to increase our country's contribution in the field of nuclear fusion," said Nascimento, 58, who heads the team operating the equipment.

According to the director of the IFUSP, the major plasma confinement projects abroad are concerned with achieving the proper conditions for building a commercial fusion reactor. "The basic process of plasma physics is not yet understood even in the Tokamak, which is the most advanced equipment in this field. Without understanding those phenomena, it is not possible to build a suitable machine," said Nascimento.

The main impetus for plasma confinement research in Brazil began with construction of the first Tokamak in 1978. According to Nascimento, who is a nuclear physicist at the USP [Sao Paulo University], the new machine now planned for our country is much larger than the previous one. "The energy accumulated in the magnetic field will total 15 MJ (15 million joules), compared to 15 kJ (15,000 joules) in the current one," he says. In addition, the reaction temperature will be 20 million degrees Celsius (the temperature at the center of the sun), whereas today we can reach only 2 million degrees Celsius.

Construction of Tokamak-2 will take from 3 to 4 years and is scheduled to begin at the start of 1989. According to Nascimento, the cost may total \$5 million, but since equipment and components are being donated, that cost should drop. The Frascati Laboratory in Italy has donated banks of capacitors, sources of current, and diagnostic equipment.

Operating costs should not increase much as a result of the new equipment, since personnel account for most of those costs. Currently employed on the Tokamak are 12 persons with doctorates, 5 with master's degrees, 2 engineers, 5 technicians, and 10 postgraduate students. According to Nascimento, the team will not be increased by much.

Cooperation

Cooperating in the USP project, according to Nascimento, are other agencies participating in the National Plasma Program, examples being Campinas State University (UNICAMP) and the INPE (National Space Research Institute, in Sao Jose dos Campos). "Brazil's

position is that it wants to move toward international cooperation in the field of nuclear fusion. To do that, we must have a strong research base," he said. According to him, no nation is in a position to build a commercial reactor by itself. "Doing so involves an investment of billions of dollars. International cooperation is essential if research is to achieve the desired objective," said Nascimento.

The director of the IFUSP, who wrote his doctoral thesis in the laboratories of the General Atomic Company in San Diego, California (in the western United States), said that the intention is to keep Tokamak-2 available to the community.

International Project

Four major international experiments in nuclear fusion are currently underway, and the first results should be achieved at the start of the coming decade. Dissemination of those results should mark the start of construction on the ITER (International Tokamak Experimental Reactor). That project is part of an international cooperation agreement between U.S. President Ronald Reagan and the USSR's Mikhail Gorbachev, and it includes the participation of four research "blocs": the United States, the USSR, Japan, and a European consortium. Participating in the ITER project will be 40 scientists (10 from each "bloc"), but the site of the reactor has not yet been decided, and that issue will probably generate some controversy.

Over 70 Tokamaks of various sizes are in operation around the world as part of the effort to achieve "self-sustained" nuclear fusion, which is an essential condition for the development of a commercial reactor. The four largest Tokamaks in operation around the world are the JET (EURATOM, Great Britain), the JT-60 (Japan), and the TFTR and D-3-D (both in the United States). All of the them have a plasma current of from 1 million to 5 million amperes, energy confinement times on the order of 1 second, and auxiliary heating of from 1 million to 20 million watts in the power beam.

Switzerland and the USSR are building two machines (known respectively as Tore Supra and T-15), which for the first time will use superconducting coils (zero resistance at temperatures below 20 K or minus 253 degrees Celsius). The TFTR has achieved the highest observed ionic temperature: 220 million Kelvin (about 10 times the temperature at the center of the sun). That value exceeds the minimum necessary for ignition of a deuterium-tritium reactor (100 million Kelvin).

What Plasma Is

Plasma is the fourth state of matter—that "beyond gas." It is a mixture of neutral and charged chemical species, and it is obtained when gases are heated to very high temperatures. Over 90 percent of the matter in the universe is in the plasma state.

The use of plasma to produce controlled nuclear fusion reactions has advantages: It has good electrical conductivity and is easy to produce. Moreover, it can be controlled by electromagnetic fields and the propagation of wave perturbations, making it possible to create good conditions for plasma containment and, consequently, nuclear fusion. To prevent destruction of the plasma during its trajectory, the Tokamak uses a magnetic field perpendicular to the direction in which the particles are flowing.

Government's Obstinacy on IBRD Loan Scored

IBRD Refusal Called 'Infantile'

53002041c Sao Paulo O ESTADO DE SAO PAULO
in Portuguese 8 Dec 88 p 3

[Text] The most serious news: The World Bank will no longer grant loans to the Brazilian electric energy sector (traditionally financed by the Bank) as long as the Brazilian Government refuses to undertake technical and economic feasibility studies on the Angra III nuclear plant. The IBRD's position is firm, as is the decision of the Brazilian government: It does not agree to the request and will not perform the studies, since it considers the construction of the Angra III nuclear plant a closed matter.

It would be useful to ask the reason for not complying with the Bank's request. The government's reply is as incisive as it is irrational: The Angra III nuclear plant is strategic for Brazil to acquire thermonuclear construction technology, and to master the complete uranium cycle.... In insisting on its nuclear program, Brasilia told the World Bank that the construction of Angra III is a question of national sovereignty. Thus, it cannot be touched.

Brazil's position is not only irrational, it is infantile. Irrational because the country does not need Angra III to meet its electric energy demand, while it does desperately need the IBRD resources, on the order of \$500 million. Without the loan approval the foreign banks, primarily the Japanese, will not provide the expected negotiated disbursement of \$600 million. That is, to construct Angra III, Brazil will immediately lose resources worth \$1.1 billion, for which there is no substitute. To evaluate what that loss of money means, it should be remembered that Eletrobras' investments, cut to the bone, should be \$2.5 billion over the next year. Losing the IBRD's \$500 million, Brazil is seriously threatened by blackout and rationing that will affect Mr Jose Sarney's Brazilian northeast, already recently lashed by a severe electric energy supply crisis precisely because of a lack of resources. Eletrobras does not have available alternate internal and external resources and is in no condition to manage a deficit on the order of 40 percent of the minimum resources necessary to meet the growing national demand.

The Sarney government's action is maddening because the World Bank at no time infringed upon or attempted to infringe upon national sovereignty—if even because it has already lent to Brazil more than \$15 billion and has never asked in return anything that might offend the sensibilities of the country. In this specific case, the Bank was very clear: It agreed even to finance the construction of Angra II, since the works are already behind schedule, even though it recognizes that the plant is expensive, and that it makes even worse the electric energy sector's serious financial situation. The IBRD, however, cannot apply money to Angra III without at least performing a technical and economic feasibility study. This is perfectly reasonable, since lenders want to have guarantees that the money will be well applied and will permit resources to be generated to pay off the debt.

The government will not agree to perform the study because it knows that it will never be able to prove the economic feasibility of Angra III (or even Angra II). What the government wants, in truth, is to absorb—if the Germans and the international bodies permit it to do so—the uranium cycle technology and embark on new adventures in the nuclear arena. The infantile part of this whole story is that neither the nuclear agreement with Germany, nor the construction of more than one nuclear plant, nor everything connected with the adventure of Mr Ernesto Geisel and Mr Paulo Nogueira Batista will bring any technological innovation in the nuclear area. It is to be remembered that Brazil closed itself off to the world when it opted to associate with the Germans. The government forgets that to develop, in such a delicate area, means to open itself up and collaborate, as all the other countries have done. But that implies assuming the promise not to embark on the path toward the atomic bomb!

On choosing to construct the plant, the government opted for rationalization! That is not the most serious thing, however. What is dramatic is that men who make decisions of that scope also decide the future of Brazil in more important economic and international matters.

Government Decision 'Unjustified'

53002041c Sao Paulo O ESTADO DE SAO PAULO
in Portuguese 8 Dec 88 p 2

[Article by Jose Goldemberg: "The Nuclear Agreement Mistakes"]

[Text] Negotiations between the World Bank and Eletrobras for the granting of a \$500 million loan to the state enterprise were suspended recently after it was shown that there were irreconcilable differences between the Brazilian negotiators and those of the Bank. This situation throws Eletrobras into a serious crisis, precisely at the time when the \$500 million loan will open the door for other loans from the Nakasone Fund and private banks, totaling some \$2 billion. Together with the rapid rise in fees charged by the electric sector, which occurred

in 1988, and the accounting agreement for old debts that had disrupted that sector, there were hopes in the medium term for improving the situation of electric energy suppliers.

The suspension of the negotiations with the World Bank has its origin in the reformulation of Nuclebras and the inclusion of the Angra II and III nuclear reactors in the scheduling of Eletrobras' works. This reformulation represented real progress in the balancing of the problematic Brazilian Nuclear Program but, on deciding to move ahead with the II and III reactors—without more studies—the government committed an imprudence that is costing a great deal and that needs to be corrected.

The World Bank reacted to the Brazilian decision on ecologic and economic grounds.

The ecological problems have ended up being resolved after difficult negotiations and the participation of technicians from the International Atomic Energy Agency, after which the World Bank reversed its political requirements calling for, in practice, Brazil's adherence to the Nonproliferation Treaty. The problems of an economic nature are, overall, more serious: Finishing Angra II is considered feasible by Bank technicians if we consider only the costs required to do so, which will reach some \$1 billion. Finishing Angra III, which is just beginning construction, is, however, considered entirely infeasible, even if the fines resulting from breaking the already signed contracts are paid. With the resources necessary to finish Angra III, argue the technicians, it would be possible to construct a hydroelectric plant generating an equal amount of power, at a cost some 50 percent less.

In these analyses, the World Bank uses the widely approved economic principle that one should first undertake the least expensive investments ("least cost option"), which shows that, in the end, a certain rationality begins to penetrate the energy programs.

The Brazilian negotiators have argued that they could be correct from the economic point of view, but that the Germans' transfer of technology to this country, as a result of the Brazil-Germany Nuclear Agreement, would not then occur, representing a greater loss than the financial losses.

The position is unsustainable and the Brazilian government should disabuse itself of it: The Nuclear Agreement with Germany has failed, despite it having cost \$7 billion, and the Brazilian government should face that reality with courage. The transfer of "sensitive" nuclear uranium enrichment technology as anticipated in the Agreement has not occurred, but it could be substituted by the autonomous program of Aramar, where Brazilian technicians from IPEN (the Energy and Nuclear Research Institute)—with their own resources and knowledge—have achieved great progress.

The remaining nuclear technology that the Germans propose to pass on to us is already totally compromised because it would require the construction of eight reactors with progressive nationalization. This number has already been reduced to four, and now to two. In reality, a good part of the Angra III equipment has already been imported, and what is involved in finishing that reactor is the civil works that have practically not been started. To risk the \$500 million World Bank loan (and the others that this loan will catalyze), so as not to displease some equipment suppliers and civil contractors, seems to be too high a price for the country.

In our opinion, the president of the republic should convoke the Superior Counsel on Nuclear Policy, created precisely for that purpose, and charge it with the decision of whether or not to complete Angra III, instead of taking a technically disputable decision, whose consequences and costs are becoming less justified with every passing day.

Seabed Arms Control Treaty Signed

51002043d Rio de Janeiro O GLOBO in Portuguese
14 Dec 88 p 9

[Text] Brasilia—Brazil acceded yesterday to the 1971 Treaty on the Prohibition of the Emplacement of Nuclear Weapons and Other Weapons of Mass Destruction on the Seabed and the Ocean Floor and in the Subsoil Thereof. Notice of Brazil's accession to the treaty was published yesterday in the DIARIO OFICIAL.

According to the Ministry of Foreign Affairs, Brazil's accession to one more treaty against the dissemination of nuclear weapons is part of the government's effort on behalf of the establishment of nuclear-free zones and world peace.

According to one diplomatic source, the delay in promulgating a treaty signed 17 years ago was due to two factors: actual procedural delays, since the document had to be ratified by the Senate and the Chamber of Deputies, and the analysis made by the sectors involved. That analysis resulted in a note of interpretation which was annexed to the ratification delivered to Great Britain, the United States, and the Soviet Union (the depositary states). The note expresses the Brazilian concern to ensure that the treaty does not prejudice Brazil's sovereign rights in the sea and its subsoil.

Safety Deficiencies of Angra Facilities Debated

51002042 Rio de Janeiro O GLOBO in Portuguese
18 Dec 88 p 32

[Report on O GLOBO interview with state deputies Luiz Paes Salles and Carlos Minc, physicist Luiz Pinguelli Rosa, and geologist Jose Mauricio Canine in Rio de Janeiro on 14 Dec]

[Text] Furnas Centrais Electricas could not have chosen a worse place to construct the first Brazilian nuclear

reactor. Itaorna Beach, in Angra dos Reis, is located in a region of extremely unstable soil, it is subject to seismic activity, and the road network that cuts through the communities of Rio's southern region is so precarious as to compromise the public evacuation plan for a nuclear accident. These, in general, were the principal criticisms made by technicians and politicians who participated Wednesday morning in the debate on the Angra dos Reis nuclear plan, sponsored by O GLOBO.

"The most worrisome aspect of the plant's security conditions is the lack of an efficient emergency public evacuation plan. The proposed plan does not anticipate the possibility of a serious accident," says physicist Luiz Pinguelli Rosa, Coordination Director of Graduate Engineering Programs (COPE) at the Federal University of Rio de Janeiro (UFRJ), one of the participants in the debate.

State Deputy Carlos Minc (PV), professor at the Institute of Earth Sciences at UFRJ and a member of the ecological movement, argued that nuclear energy produced by the plant could be replaced with natural gas, one way of definitively eliminating the risks of radioactive accident. State Deputy Luiz Paes Salles (PT), health specialist and former director of the Angran Society for Environmental Protection, spoke on behalf of the mayor-elect of Angra, Neirobis Nagae, also of the PT, and said that the uninformed public lives in a state of permanent fear. "If an accident were to occur, no one would know what to do," warns Paes Salles.

And geologist Jose Mauricio Maciel Canine of the Department of Mineral Resources of the State Secretariat for Industry and Commerce, and professor at UFRJ, states that the soil conditions are the worst possible for hosting the atomic reactor.

Although they were invited, technicians for Furnas (the state enterprise responsible for the operation of the plant), the National Commission for Nuclear Energy (CNEN) and the Special Service for Civil Defense of the Ministry of the Interior did not attend. Representatives of the three organizations stated that their technicians had full schedules.

O GLOBO: The seismic activity that occurred recently reignited the debate on the safety of the nuclear plant. What are the real risks of an accident?

Carlos Minc: I would like to quote a piece from the book entitled "Memories—30 Years of Energy and Development," Furnas edition, which details how the plant location was selected. Flavio Lyra de Silva (former director of Furnas) traveled to several areas—Grumari, Prainha, Muriqui, Ponta Negra, and Mambucaba—by airplane and car. One afternoon he flew over a very long beach covered with thick vegetation (Itaorna) and said to a companion, "This seems like the right place. Let's come back tomorrow by car."

O GLOBO: And what are the risks of an accident?

Luiz Pinguelli Rosa: In the first place, let's touch on earthquakes. This is not a problem because the buildings housing the reactor and the highly radioactive waste have been calculated to withstand an acceleration caused by seismic activity of up to a tenth of the force of gravity both vertically and horizontally. That corresponds, approximately, to 7 points on the Mercalli scale and 5.6 on the Richter scale. The recent earthquakes have not even registered on the instruments. I had the opportunity to visit the plant and I verified that several problems remain to be solved. One of them I consider serious: the steam generator at Angra I. The metallic connection used in the generator is of inadequate quality. It was a project error. It is known that there will be problems with corrosion and it is necessary to have permanent monitoring. The most serious problem, however, is the emergency plan, very precarious, as one can verify in a visit to the CNEN. The big risk with a nuclear plant is the lack of refrigeration. Even if the nuclear fission reaction is arrested, the radioactive material that is there—cesium, among others—emits particles, and that emission heats the water. The reactor is like one of those cars that, when you take out the key, continues to run. And it will do so for many days. If the primary circuit is broken and the water is lost, that heat, even after the reactor is shut down, has nowhere to go and spills out at the base of the tower, onto the cement. And the radioactive material spreads into the soil and contaminates the entire region. The other possible accident is, in that same process, an explosion, not nuclear, because this is not a bomb. That explosion would blow up the building and would spread radioactive material everywhere.

O GLOBO: What information do you have on that plan?

Carlos Minc: Days before the promulgation of the Constitution, President Sarney released a decree transferring responsibility for evacuating the population to the Army. This means that, if there were a serious accident, those 18-year-olds who tried to resolve a social matter in Volta Redonda, with the well-known results, are going to have to deal with the panic of 65,000 people. They are going to have to convince those persons politically, socially and psychologically that they have to leave.

Luiz Pinguelli: I agree with Minc's statements about the Army's activities, especially the uncoordinated manner in which the matter is being dealt with. But we should recognize that the Army will have better means of mobilization and transport equipment, that is, cars. The previous plan anticipated bringing in hundreds of buses from Rio, at the same time as the population would be trying to escape from there by their own means. However, we were not able to determine from the CNEN just how this would be done. It is not only the Army's problem. We understand that the minimum measures that we have been requesting for some time are not being taken. The largest accident that has been planned for is much less serious than what could happen, that is, they never admit that the structure of the building could be broken, that cement and iron dome. They refuse to

admit that a sudden release of a large quantity of material could occur. Even so, the radioactivity could reach a radius of up to 15 km in 15 days.

O GLOBO: And how does the population of Angra view the danger of the nuclear reactor?

Luis Paes Selles: About a year ago, we had a vote in the city and the people, by a wide majority, were against the operation of the nuclear plant. They had concrete reasons for mistrusting its safety. The decision on the project's location was arbitrary and imposed upon us, without consulting anyone. They created propaganda preaching the benefits that the plant would bring—employment and wealth for everyone. The population has been disappointed and is now distrustful, if even because the benefits never appeared. On the contrary, slums have developed and there is much unemployment. On the question of safety, the population does not know what type of accident could occur. There is not the slightest information available on the matter. The evacuation plan has never been discussed. It was a secret until 2 years after the beginning of the plant's operations, and has only been made public because of pressures exerted by some deputies. And what was the surprise? It was a totally infeasible plan, a fiction. If an accident were to occur, more people would die trying to escape from the city than from the consequences of the radioactivity itself.

O GLOBO: Does the new mayor, from the PT, have a concrete proposal with regard to the plant?

Luiz Paes Selles: Neirobis Nagae is a former participant in the ecological movement. He, obviously, does not have the powers to shut down the plant, but he has promised now to act in the most effective way to ensure that that reactor operate only under safe conditions and if the population so desires.

O GLOBO: Has the seismic activity proven that the region is inappropriate for the construction of a nuclear plant?

Jose Mauricio Canine: We would like to have on record that the Department of Mineral Resources was never at any time consulted, even though at the time it possessed a sufficiently large team of geologists, responsible for the formulation and execution of mineral policy and geological mapping of the State of Rio. This mapping, delivered in 1983, demonstrated that there was a great number of faults, that these faults are not isolated, but are rather a system of faults. Now, where were the other faults around that area, in the other municipalities? No one knew. We are not acquainted with the mapping completed in the 1970's, when the work was initiated. From the point of view of safety, we do not have a concrete framework because we have not worked in conjunction with Furnas. There is no cooperation. From the geological point of view, there is no imminent danger of a big earthquake. The likelihood is extremely small.

Carlos Minc: But it is not zero...

Jose Mauricio Canine: In fact, it is not. But it is small enough. But we understand that the plant should have been built in a geologically appropriate area, preferably in an uninhabited place. Why Itaorna? That region of faults is riddled with diabasium, a type of rock that creates a reddish soil and is extremely unstable.

Luiz Pinguelli: The Angra I building is anchored on a rock quite close to the surface. But to construct Angra II, they needed to drill up to 40 meters before finding firm rock. It was terribly expensive. They had to modify the structure of the plant because the deepness was increased by 20 to 40 meters. And Angra III, which was to be built nearby, was moved to another location, farther away.

Jose Maciel Canine: I did not follow what was happening but, through the knowledge I have acquired over 20 years in the profession, I can conclude that something must have occurred from the geological point of view. If Angra I was on top of a point of rock and, in the case of the other plants they did not know exactly how deep they would have to go, maybe that means that the appropriate soundings were not made. Sounding firms would not commit elemental errors such as these. If you had an error of 40 cm, that's acceptable. But an error of 20 meters is unacceptable. It appears to me that the soundings were not performed within the necessary technological criteria.

O GLOBO: And the atomic waste?

Luiz Pinguelli: There are, by our calculations, 15 tons of highly radioactive material deposited in a pool of water that until now has conformed to safety norms. That, however, does not totally eliminate the possibility of an accident. Among that waste, there is plutonium 239 and uranium 235, used to build atomic bombs. There is strict international monitoring of these two elements.

O GLOBO: Would the conversion from nuclear energy to natural gas be feasible?

Carlos Minc: I believe so, and the cost of that conversion would be on the order of \$500 million. But in Angra's case, it is interesting to analyze three aspects: in the first place, you do not lose everything, you take advantage of part of what has already been done; the second point is that the gas from Bacia de Campos passes close to Angra dos Reis; finally, in the case of Angra III, which has not even been built yet, or of Angra II, which is not completely finished, the costs would be much less.

CNEN Director: Risk of Accident Is Small

National Commission for Nuclear Energy (CNEN) Executive Director Luis Alberto Arrieta said that the external emergency plan adopted by the Angra nuclear plant conforms to international safety standards. According to him, the possibility of a serious accident, with rupture of

the protective dome and the sudden release of a large quantity of radioactivity, is infinitely small.

"Even if that were to happen, the spread of radioactive material is slow, and would give sufficient time for the internal emergency plan to be activated, now the responsibility of the army and other institutions, such as CNEN itself, the DNER and the Civil Defense," he observed.

With respect to the final storage site for low and medium level radioactive waste, Luis Arrieta said that CNEN has already evaluated various areas but the final decision depends upon the approval of specific legislation from the Congress, which requires the states to identify localities for that purpose. The highly radioactive waste, according to the CNEN director, is being stored at the plant site itself, in a pool, and could be maintained there for another 10 years with no problem and with the reactor operating normally.

"The permanent storage of that fuel is a question for which there are various alternatives being discussed and evaluated in Brazil, as well as in the majority of the developed countries. However, the matter of the so-called highly radioactive waste does not require an immediate decision," Arrieta clarified.

Furnas Director for Thermonuclear Production Marcio Costa received a questionnaire on the criticisms formulated during the debate, but he has not responded. He told his aides that he was very busy and did not have the time to answer questions.

Government Yields on Angra III Feasibility Study 31002043c Sao Paulo O ESTADO DE SAO PAULO in Portuguese 28 Dec 88 p 23

[Text] The government has yielded to the demands of the World Bank (IBRD) and is conducting an economic feasibility study of the Angra III nuclear power plant. The study is being carried out by Eletrobras [Brazilian Electric Power Companies, Inc.], which has been responsible for the nuclear power plants since August, when Nuclebras was abolished. In Sao Paulo yesterday, Eletrobras chairman Mario Bhering announced that the study would be submitted to the IBRD in mid-January. He said: "We will prove to them that Angra III is viable, and there will be no more arguments to prevent the \$500 million line of credit from being made available to the electric industry."

In his opinion, the government's attitude cannot be viewed as reflecting a "radical change" in its decision (Planalto Palace had previously argued insistently that this was a matter of national sovereignty). "The IBRD wants to rediscuss the Angra III problem, and this does not mean interference in the Brazilian nuclear program, because we have agreed only to make this study," Bhering explained. If the IBRD is not convinced, the country's situation will be quite difficult in 1989. Besides

that \$500 million, Brazil will also not receive two parcels totaling \$600 million each and another \$450 million from the Nakasone Fund, the granting of which was made dependent upon release of the World Bank funds.

He said: "We have to invest about \$6 million per year to keep up with the growth in consumption. This year, however, half of the \$10 billion we billed was spent to service the foreign debt, and when all is said and done, we were able to invest less than \$4 billion" ["million" and "billion" as published]. If the IBRD does not accept Angra III, for example, Eletrobras' cash position will be reduced by \$2.15 billion, that being the sum total of all the pending lines of credit.

Ipero Environmental Reports To Be Public
51072043b Sao Paulo O ESTADO DE SAO PAULO
in Portuguese 20 Dec 88 p 14

[Text] Ipero—The scientific community and the public will be in a position to follow and monitor possible environmental changes caused by nuclear activities at the Aramar Experimental Center in the municipality of Ipero in the Sorocaba region. This was announced in Ipero yesterday by Rear Admiral Othon Luis Pinheiro da Silva, chairman of the Navy's Special Projects Coordinating Group (COPEP), during the inauguration of the Radioecological Laboratory built at the Aramar center.

According to him, all research and analyses of samples of water, sediment, fish, meat, and plants in the region will

be made available to the interested public and the scientific community so that they will be aware of radiation levels. "We want to prove that there is no danger of contamination from radiation as a result of the research and tests we are carrying out and will continue to carry out here."

In order to make a quantitative comparison with the results of future analyses, preoperational monitoring was carried out in the region where the Aramar Experimental Center has been set up. This involved analyzing radiation levels in the water, air, sediment, fish, milk, plants, and food. The results of those analyses are on file at Registry 4 of the Sao Paulo Registration Office for Deeds and Documents and are available to anyone interested.

The Radioecological Laboratory was inaugurated yesterday in the presence of the commander of the 4th Regional Air Command, Brigadier General Marcio Nobrega Ayrosa Moreira. It is part of the Aramar security complex, where uranium enrichment by the ultracentrifugation process has been underway since April of this year. The program for environmental monitoring is suited to weather conditions in the region and is intended mainly to detect possible changes in the existing natural radiation levels.

The laboratory, which cost 63,000 OTN's [National Treasury Bonds], or about 3.5 billion cruzados, was paid for out of the Navy's budget. It will also be used by agencies and organizations in the region to carry out conventional chemical analyses, thus providing a public service.

INDIA

Navy To Display Nuclear Submarine on 15 February

BK2301083589 Hong Kong AFP in English
0722 GMT 23 Jan 89

[Text] New Delhi, Jan 23 (AFP)—India plans to display its lone nuclear submarine next month in a display of naval might off the country's west coast, Defence Ministry officials said here Monday.

The Indian Navy's nuclear-powered submarine "Chakra" (Battle Wheel) will join a major naval parade on February 15 in the Arabian Sea as part of a ceremonial Navy Day review lined up for President Ramaswamy Venkataraman, the officials said.

The "Chakra", on lease from the Soviet Union, would lead a line-up of India's two aircraft carriers, five frigates and several other warships during the review in honour of the president who is also the supreme commander of India's armed forces.

The review is also open to civilians, the officials said.

The last such naval review was organised in 1984 during former President Zail Singh's tenure.

India acquired the SSRN-I class "Chakra" from the Soviet Union in April amid reports from defence strategists that the long-range vessel was the first of a series of three.

The nuclear-powered submarine, which India says is unarmed, has been conducting top secret exercises in the Bay of Bengal and has been kept from public view since its arrival.

The Indian Navy has traditionally been dependent on Soviet equipment. Sixty percent of India's total military requirement is supplied by Moscow.

ISRAEL

Book Reveals Appeals to India To Bomb Pakistan

TA2401121389 Tel Aviv HADASHOT in Hebrew
24 Jan 89 p 2

[Report by Ilan Kfir and London-based correspondent Victor Levi]

[Text] "Israel has attempted three times in the past to persuade the Indian Government to carry out a joint attack on Pakistan's two nuclear reactors in Kahuta and in Pinstech. The Indians refused, but their decision will soon change, in accordance with the rate of progress of its neighbor's nuclear program."

This new revelation appears in a book published in London entitled "Nuclear Rivals in the Middle East." The book ties the Israeli appeal to India with the fact that former Pakistani Prime Minister Zulfikar Ali Bhutto used Libyan financing to produce the "first Islamic atomic bomb."

In addition, the book states that, despite poor relations between Libya and Egypt, the Al-Qadhafi regime has maintained its contacts with Egyptian nuclear scientists, and many of them have settled in Tripoli. The author, Shiham Bathiya [name as published], claims that if relations between the two countries improve, these scientists will provide the infrastructure for a pan-Arab nuclear industry. Shamir and Arens sent a message to New Delhi yesterday, stating that Israel is interested in setting up full diplomatic relations with the Indian Government. The message was delivered through a delegation of senior Indian journalists, who are the guests of the Foreign Ministry.

Shamir told the delegation that "Israel feels great affection and respect for the ancient people of India. If your government agrees, we are prepared to commence cultural contacts and later expand them to full diplomatic relations."

PAKISTAN

Facing the Challenge of Nuclear Option

46000061z Islamabad THE MUSLIM in English
1/3 Dec 88 p 4

[Article by Ikram Ullah]

[Text] Kahuta had surprisingly and unwittingly become a major election issue. It sparked off a campaign duel between the IJI and the PPP. The innocent voter totally ignorant about the factual position was pushed to a point by some publicity agencies that the security of the state of Pakistan was in danger. The Cochairperson of the People's Party offered a public debate to remove the clouds. The dust settled down without such a debate as wiser counsels prevailed not to make a sensitive issue like Pakistan's nuclear study an instrument for vote catching. It is not an exclusive domestic issue. It has regional and global implications far more complex than the Afghanistan policy or our relationship with India.

Nuclear Club

Pakistan's pursuit for nuclear energy for peaceful purposes has plagued our relationship with the nuclear club countries over the past two decades. They are all determined that, Pakistan, at all costs, must be prevented from acquiring this technology. To date, the United States has been acting, for whatever reasons, as the leader and spokesman of this club. It has been chosen to perform this role for obvious reasons. It is the only country which has the ability to turn off the economic and military aid that has sustained Pakistan since our

birth in 1947. Self-reliance is a mere slogan and as much a far cry as ever before. Without economic independence, political freedom is stripped of much of its true meaning. With the dawn of a new era in Pakistan, as we stand on the threshold of much coveted democracy, our financial bankruptcy speaks volumes. This is the yardstick by which the performance of the outgoing regime can be judged and measured. Zia said in July 1977 that Bhutto had left him an empty kitty. Bhutto's daughter does not seem to have inherited anything better in 1988.

Zulfiqar Ali Bhutto was beset with many problems when he took over the task of governing Pakistan in December 1971. Seventeen years later in December 1988, Mohtarma Benazir Bhutto faces a worse scenario, both domestic as well as global. And she has a long way to catch up with her father's stature, political acumen and perception of the virulent power games which consume the Third World all the time. The nuclear option is one such lethal issue.

The idea of developing nuclear energy was the brain child of Zulfiqar Ali Bhutto. In India it was Jawaharlal Nehru. In Israel, Prime Minister David Ben-Gurion conceived the idea in 1957. Both India and Israel have long since joined the club, without any protest. On the contrary the Western response has been not only encouraging but gleeful. France and the U.S. actively helped Israel in acquiring the technology. There is ample evidence to justify this assertion. The motive was to equip Israel with a veto against the Arabs in general and Palestinians in particular. Denying a U.S. visa to Yasser Arafat to address the United Nations General Assembly in New York speaks louder than any other argument, on the subject of American love for Islam or freedom. Similarly, India's explosion of a nuclear device in 1974 was joyfully received by the West as a counterbalancing feat against China in Asia. It did not stop there. In September, 1979, there was a 'mystery flash' somewhere in the South Atlantic or Indian Ocean area. Initial announcements attributed the flash to a South African device. Later in February 1980, the CBS network of the United States attributed the explosion to Israel. In other words, at first the inference was that the blast was a South African bomb, probably aided by Israel. But the CBS report, five months later converted it into an Israeli bomb, probably aided by South Africa. Since then, there have been many alternative theories to wash out and eliminate the dust that was raised over this "mystery flash." Those governments that are eager to minimise the chances of a nuclear arms race either in Africa, in the Middle East or South Asia, would in any case have been inevitably tempted to opt for a scenario which would not portray either South Africa or Israel as nuclear powers. This attitude of the club is certainly bad news for Pakistan, for the World of Islam and also for the African people, particularly the blacks in South Africa struggling for self-determination, freedom and democracy.

The Prime Minister, Mohtarma Benazir Bhutto has inherited a paradoxical situation which in the current global backdrop is not easy to handle. The interests of

Pakistan and those of the U.S. and its other allies like Israel not excluding India, clash violently over this issue. Zulfiqar Ali Bhutto fought a gallant battle and risked his neck for what he believed to be a just cause. No one knows how much Pakistan has moved forward in this delicate area since 1979. For one thing the conflict in Afghanistan has been a focusing in disguise insofar as the softening of the U.S. attitude is concerned. But, once the Russians are out of Afghanistan, hopefully by February 1989, the Symington axe might again appear over the mushroom clouds of Kahuta.

One fact is quite evident. Except for their own trusted bedfellows, the great powers do not trust Third World countries with nuclear technology and least of all, any Muslim country like Pakistan. There is a theory that this distrust could become an asset if the threat of nuclearisation of the Third World creates enough consternation in the northern hemisphere to result in a massive international movement to declare nuclear weapons illegal for all, and to put an end to nuclear arsenals in every country that has them. According to Professor Ali A. Mazrui of the University of Michigan, who was recently in Lahore, what this theory means is that although greater risk of nuclear war comes from vertical proliferation in the northern hemisphere and only secondarily from horizontal proliferation in the Third World, the vertical variety in itself has not been enough to end this dangerous nuclear order. The "vaccination" of horizontal nuclear proliferation might be needed to cure the world of this nuclear malaise—a dose of the disease becomes part of the necessary cure.

Challenge

As far as Pakistan is concerned, its entire defence strategy has always been evolved in relation to the threat faced by it. Basically Pakistan's economy is ambivalent about militarism and rearmament. The rest of the Third World also shared this doctrine of nonalignment. So great was India's image in this respect that Uganda's Milton Obote described Nehru as "the founder of non-alignment." But how distantly related were the two doctrines of non-alignment and non-violence! Gandhi once said "Free India can have no enemy. For India to enter into the race for armaments is to court suicide. The world is looking for something new and unique from India. With the loss of India to non-violence, the last hope of the world will be gone." But in spite of Gandhi's vision, independent India did not practice abstinence. Gandhi's non-violence was not fully translated either into foreign policy or defence procurement. Nor indeed into the domain of nuclear technology.

India's non-violence and non-alignment was destined to go nuclear. India was indeed the first non-aligned country to explode a nuclear device. India was also the first country without a permanent seat in the Security Council of the United Nations, to go nuclear. The first five nuclear powers were precisely the warring states with the veto in the Security Council—the United States, the Soviet

Union, Great Britain, France and the People's Republic of China. India at last had broken this neat equation and put the issue of nuclear proliferation on a new footing.

With Israel and South Africa having joined the club, the issue of nuclear non-alignment becomes a contradiction in itself. Pakistan finds itself in a difficult and dangerous position. After what happened to Baghdad, there has been talk of threats to Kahuta. It is strange and significant that when India tells the world that it will use its nuclear capability for peaceful purposes, everyone believes it. No one pays any heed to what Bangladesh, Sri Lanka and others, including Maldives have gone through. But strangely enough, when Pakistan assures the world, repeatedly, that it has no desire to put its nuclear technology to military use, everyone raises an eyebrow and threatens a veto.

The biggest challenge the Prime Minister of Pakistan faces today is the nuclear dilemma. Her father lost his life but did not give in on this issue. It is a political minefield through which she will have to tread with the utmost skill of diplomacy and statecraft.

Spokesman on 'Nonattack' Accord on Nuclear Sites

BK2401033089 Islamabad Domestic Service in Urdu
0200 GMT 24 Jan 89

[Text] Pakistan will totally adhere to the accord signed with India last month on nonattack of each other's nuclear installations. A Foreign Office spokesman told newsmen in Islamabad that Pakistan will fulfill all the conditions of the accord. Now only the ratification of this accord remains, and the accord will come into effect on the day the documents of ratification are signed.

Asked whether India has provided information on its atomic installations to Pakistan as per the accord, the spokesman said that each country should give the other details of its nuclear installations.

Talks Under Way To Acquire French Power Plant
BK2401150989 Hong Kong AFP in English
1442 GMT 24 Jan 89

[Text] Islamabad, Jan 24 (AFP)—Negotiations were continuing between Pakistan and France for the purchase of a French nuclear power plant to offset the country's energy shortage, a Foreign Office spokesman here said Tuesday.

Reiterating Pakistan's resolve to acquire nuclear energy for peaceful purpose, he said the plant required from abroad will be subject to international safeguards. But there has been no agreement with France so far, he said.

Pakistan floated international tenders in 1982 for the purchase of a cluster of light-water 900-megawatt capacity nuclear power plants to be installed at Chashma in the Punjab, alongside a nuclear reprocessing plant France had agreed to supply in 1976.

The latter deal was unilaterally scrapped by France under U.S. pressure, though Pakistan continues to urge France to honour the commitment.

Pakistan has received no bids for its Chashma complex, though reports here said France had expressed an interest in settling the ongoing dispute.

Pakistan went to the International Chamber of Commerce and Industry to force France to honour the deal. Its claim worth millions of dollars in compensation was upheld but Paris reportedly desired an out of court settlement.

Observers here expected an agreement might be possible before President Francois Mitterand's expected visit to Pakistan in September this year.

Asked whether the proposed nuclear power plant was linked to the settlement of the claim over the reprocessing plant the spokesman said that "at a certain stage a package may be possible."

France is already assisting Pakistan in enhancing its energy generating capacity through conventional means. It has provided turbines for a thermal power plant at Kot Addu in southern Punjab, which is to be formally opened by Prime Minister Benazir Bhutto on Wednesday.

Pakistan is also cooperating with China in the nuclear field, and the spokesman stressed this agreement is for "peaceful exploitation of nuclear energy."

Pakistan has denied that it has or is trying to achieve nuclear military capacity.

Spokesman Denies Country Has Nuclear Bomb
BK2901060589 Islamabad Overseas Service in Urdu
0500 GMT 29 Jan 89

[Text] Pakistan has denied the report that it possesses a nuclear bomb. A Pakistani Embassy spokesman told Reuter in Washington that this kind of weapon may create instability in the region.

The spokesman added that doubts were created about this by the activities of the past military dictatorship, but there is no inconsistency in the words and deeds of the newly elected government in this regard.

Program for 'Peaceful' Use
BK2901160289 Islamabad Domestic Service in Urdu
1500 GMT 29 Jan 89

[Text] Pakistan will hold consultations with the United States and will convince it that Pakistan's atomic program is only for peaceful purposes and its objective is to increase the production of electricity so as to meet the growing need for power.

A Foreign Office spokesman told newsmen in Islamabad today that Pakistan needs atomic energy for various developmental activities, including development in the sectors of industry, electricity, agriculture, and health. According to a U.S. press report, the Reagan administration, before stepping down, told Congress that it could not authenticate that Pakistan's atomic program was peaceful because Pakistan is close to making an atomic bomb.

Pakistan's embassy in Washington has already rejected this report. Citing Prime Minister Benazir Bhutto, the embassy said that Pakistan's atomic program is totally peaceful and its only objective is to acquire energy.

The Foreign Office spokesman strongly rejected a report that the Pakistani Embassy in Bonn had smuggled

nuclear materials from the Federal Republic of Germany.

On the meeting of the proposed Afghan mujahidin's consultative group, the spokesman said it will probably be held on 10 February. The seven-party Islamic Alliance of the Afghan mujahidin and the 8-party alliance of the Iran-based Afghan mujahidin are trying to form a consultative committee so as to form a broad-based government in Afghanistan.

Indigenous Rocket Launched Into 'Deep Space'
BK2901065789 Delhi Domestic Service in English
0630 GMT 29 Jan 89

[Text] Pakistan is reported to have successfully launched an indigenous multistage rocket into deep space. Reporting this, the Karachi daily DAWN said the rocket was test fired at the Space and Upper Atmosphere Research Commission's test range at Somiani on the 10th of this month.

The rocket reached an altitude of more than 640 km and carried a scientific payload of more than 150 kg. The payload was later recovered.

CANADA

Report Prompts Health Study Call in Nuclear Reactor Area

51200012 Ottawa *THE OTTAWA CITIZEN* in English
3 Dec 88 p A3

[Text] Pickering, Ont. (CP)—A Durham Region citizen's group has called for a comprehensive study of the health effects of the Pickering nuclear reactors with the release Friday of a report linking tritium emissions and birth defects.

The report, prepared by free-lance writer David McArthur and released by Durham Nuclear Awareness, found a higher rate of deaths due to birth defects in years when there were also large releases of tritium into the water and air.

There are inconsistencies in the findings, however, and the sample size is so small that any relationship between emissions and birth defects could just be coincidence.

The report doesn't prove that the tritium emissions caused the birth defects, McArthur acknowledges, although he believes they are related.

"These findings are what one would expect to see in a population exposed to tritium based on experiments on lab animals," he said. "Tritium is released in enormous quantities from Pickering nuclear generating station. Tritium is readily ingested by people and it is even absorbed through the pores of the skin."

But the report doesn't have to prove a link between the nuclear plants and birth defects to be alarming, said Irene Kock of the Durham Nuclear Awareness group.

"We are not linking this definitively to tritium," Kock said. "We are waving a flag. We are saying, 'Excuse me, there seems to be a problem here, we'd like the appropriate ministry to take a little closer look.'"

A spokesman for Ontario Hydro, which operates the Pickering nuclear station, said Friday that McArthur's report was inconclusive.

"I don't think they've made a case yet," said Gerry Armitage, manager of health physics services for the provincial utility. "What they've done is look at the data, which has been available for many years, and try to make a connection, which may or may not exist."

But the provincial utility does support the call for an epidemiological study.

500-Liter Heavy Water Spill in Ottawa River Detected

51200013 Windsor *THE SATURDAY WINDSOR STAR* in English 17 Dec 88 p A6

[Text] Pembroke, Ont. (CP)—An estimated 500 litres of radioactive heavy water got into the Ottawa River during a Dec. 8 spill at Chalk River Nuclear Laboratories, says a company spokesman.

The leak is believed to [be] the largest radioactive discharge into the river in at least 20 years.

Company official Hal Tracey said that the leak was not detected until Wednesday following routine testing of substance discharged to the river from the plant.

Officials stressed a spill of 2,000 kg of heavy water containing radioactive tritium had caused no damage outside the plant, heavy water is used to moderate the nuclear reaction in the Canadian Candu nuclear reactor.

But by then, staff noticed about a quarter of the spilled heavy water was missing after they mopped up.

Tracey said the heavy water in the Ottawa River does not pose a health hazard to people living downstream. The river supplies drinking water to Ottawa and surrounding communities.

Lorna Evans, the plant's public affairs manager, said samples of the plant's discharge likely contained less than 10,000 Curies of radiation. A Curie is a measurement of radioactivity in a substance.

The maximum permissible amount of tritium that can be released in one day into the river by the Chalk River plant has been set by the Atomic Energy Control Board at 28,000 Curies.

Attitudes Toward Nuclear Power Use Surveyed

51200011 Toronto *THE GLOBE AND MAIL*
in English 19 Dec 88 p B6

[Article by Bertrand Marotte]

[Text] Montreal—Only 17 per cent of Canadians are strongly in favor of using nuclear energy as one way to generate electricity, a poll commissioned by the Canadian Nuclear Association indicates.

There has, however, been some decline during the past year in the percentage of people who strongly oppose its use, the survey found.

With sales of reactors sagging and public resistance to nuclear power continuing, particularly after the Chernobyl nuclear disaster in the Soviet Union two years ago, the CNA embarked last year on an ambitious advertising and education campaign to change people's minds about its safety and appropriateness.

The Toronto-based CNA also began commissioning polls—conducted by Decima Research Ltd. of Toronto—to track public attitudes toward nuclear power. The latest poll consisted of a random telephone survey of 1,200 adult Canadians, 18 years of age and older, conducted between Nov. 25 and 27. Decima says the results of such a survey are accurate to within 2.9 percentage points, plus or minus, 95 times out of 100.

Last year, nuclear power provided about 15 per cent of the total electrical supply in Canada. Ontario, Quebec and New Brunswick are the only provinces with nuclear reactors, and Ontario derives about half of its electricity from nuclear generating stations.

The poll indicated that 17 per cent of those questioned were strongly in favor of using nuclear energy, up from 12 per cent in a similar survey conducted in October, 1987. Forty-five per cent said they were "somewhat" in favor, up from 39 per cent a year earlier.

Twenty-two per cent of those polled said they were somewhat opposed, down from 25 per cent in October, 1987, while 15 per cent said they were strongly opposed, down from 24 per cent a year earlier.

Ian McKinnon, president of Decima, said at a news conference yesterday that the results show that Canadians "may not love nuclear power but we're realistic about it."

He said the survey results indicate that Canadians think they have no choice but to rely on nuclear energy as an important source for future electricity demand. Canadians realize the high environmental cost of generating electricity from coal and also that they are running out of untapped water resources for hydroelectric projects, he said.

One of the most striking differences measured was the one between men and women respondents. While 22 per cent of the men polled said they were strongly in favor of nuclear energy, only 11 per cent of the women said the same.

In addition, 19 per cent of anglophone respondents said they were strongly in favor of nuclear energy, compared with 9 percent of francophones. Twenty-one per cent of anglophones said they strongly opposed nuclear energy, compared with 25 per cent of francophone respondents.

(A 14-page report by Goldfarb Consultants of Toronto, prepared in August, 1987, for the CNA, recommended that it aim its multi-million-dollar ad campaign at married women with children who are in the lower income and education category, because they showed strong resistance to nuclear power and had the highest potential of being persuaded to take a more neutral stance.)

In another question, respondents were asked whether they thought nuclear energy was a "good," "bad" or "realistic" choice for large-scale use. Fifty-seven per cent said they considered it a realistic choice, compared with 53 per cent in October, 1987; 21 per cent said they thought it was bad, compared with 32 per cent; and 21 per cent said they felt it was good, compared with 15 per cent.

Only 34 per cent of respondents, however, said they agreed that the nuclear industry is capable of handling its radioactive nuclear waste.

Other polls conducted by Decima for CNA last year indicated that 61 per cent of Canadians do not believe scientists can find a secure place to store dangerous radioactive waste for the thousands of years required before it is safe.

Fifty-one per cent of those polled last year also said they think there is no such thing as an "acceptable" level of radiation.

Mr. McKinnon said "an alarmingly high number"—38 per cent—of respondents in this year's survey believe uranium exported by Canada finds its way into the nuclear weapons chain.

The CNA, which represents more than 100 companies, utilities or government agencies in the nuclear industry, will spend about \$3-million a year over three years on its advertising and education campaign, said Rita Dionne-Marsolais, CNA vice-president of information. Between \$2-million and \$2.5-million of that goes to advertising, she said.

A key member of the CNA—as well as a major contributor to the advertising campaign—is Atomic Energy of Canada Ltd., the federal Crown corporation that is heavily subsidized by Ottawa.

Instrument To Spot Plutonium Theft From Spent Fuel Rods

5120X010 Toronto THE GLOBE AND MAIL
in English 19 Dec 88 p A3

[Excerpts] Winnipeg—Canadian scientists say they have perfected a powerful new instrument to detect the theft of plutonium—a key ingredient in nuclear bombs—from spent reactor fuel.

The device will be used at reactors throughout the world, says Dennis Chen, a research scientist at the Whiteshell Nuclear Research Establishment At Pinawa, Man., who helped develop the device.

"You can actually see radioactivity," he said in an interview. "It's like looking at embers glowing in a fire. It's a sort of red glow." The camera-like device measures

the radioactivity of used fuel rods, which are stored in sealed cylinders in what amounts to large swimming pools.

Mr. Chen said he and colleague Cary Young are among the first to successfully develop the portable hand-held instrument, beating Japanese and U.S. scientists who are working on similar devices.

He said a version has been tested in Sweden but he believes the Canadian instrument is superior. Five have been bought by the International Atomic Energy Agency, which monitors the supply of weapons-grade nuclear fuel for 113 member countries. The instruments cost \$25,000 each.

Mr. Chen has been working on the project for the past eight years at the federally owned research facility of Atomic Energy of Canada Ltd. about 100 kilometres northeast of Winnipeg. It cost about \$1-million to develop the instrument.

Until now, testing has relied on the more awkward and time-consuming method of attaching a Geiger counter to a pole and dropping it into a pool where the rods are stored.

The new instrument is able to see radiation with the aid of an ultra-violet lens. "The image comes through the lens and is multiplied 10,000 to 20,000 times," Mr. Chen said. "That electronic image then hits a TV screen and then you then see the image. "What our device will be able to do is to say, 'Hey, reactor operator, this is your fuel and we're not seeing any radiation glow from it.... It could be that you're diverting the fuel and extracting the plutonium from it to make an explosive device.'" [quotation marks in paragraph as published]

Jean Beare of the Atomic Energy Control Board in Ottawa said the theft of plutonium is a serious concern. "That's why the safeguards of this international agency exist."

The new instruments will be manufactured at the Whiteshell AECL facility using Canadian and U.S. components.

FEDERAL REPUBLIC OF GERMANY

Economic Minister Haussmann Supports Liberal Export Regulations
AU1701160489 Munich SUEDEDEUTSCHE ZEITUNG
in German 7 Jan 89 p 21

[Helmut Maier-Mannhart report on interview with Economic Minister Haussmann: "FRG Foreign Trade Will Remain Liberal"; date and place not given]

[Excerpt] Munich, 16 January—There will be no fundamental change in the FRG's foreign trade policy after the incidents surrounding the export of nuclear and chemical plants, which are currently causing some political stir. This was declared by Economic Minister Helmut

Haussmann in a talk with SUEDEDEUTSCHE ZEITUNG. During his forthcoming visit to Washington in early February he wants to counteract U.S. demands for stricter checks by referring to the stepped-up checks for sensible goods, which have now been agreed upon, and, in addition, outline the advantages of the liberal system. Concerning the future reform of the company tax, which is to come into force on 1 January 1993, Haussmann sees more things in common with the CSU than with the CDU, with which he expects sharp controversies in social policy in the next few months.

Haussmann made it clear that the FRG Government will continue to adhere to the principle that free export has to be the rule, and controls the exception. Considering the sheer number of 2.5 million export consignments a month, this cannot be done otherwise for mere practical reasons. Moreover, one must not forget that the export of weapons amounts to only 1 percent of total exports, Haussmann said. However, this does not exclude the fact that, on the basis of experience that has been gathered concerning the illegal exports to Libya and Pakistan that have now come to light, this area has to be dealt with more strictly, the economic minister noted. In this context, he referred to the sensible goods that are included in the list of the Coordinating Committee for Multilateral Export Controls. Although this list applies only to trade with the East Bloc states, it will now be extended to several other countries. Moreover, the foreign trade law and the foreign trade decree contain a catalogue of the goods that are subject to approval.

Therefore, the problem is not the fact that these products have to be defined; the question is how illegal deliveries can be avoided in the future, Haussmann said. He considers that an effective approach lies in the exchange of data between the individual authorities that grant licenses, namely customs offices, the Federal Economic Office, and the nuclear authorizing offices. Such an exchange, which will obviously give rise to the problem of data protection, would make cross-examinations and special checks possible, without which such illegal practices cannot be forestalled, Haussmann said. Moreover, if one could do away with excessive profits from such transactions, people would be less encouraged to carry them out in the first place. [passage omitted]

Industry Involved in Nuclear Deals
AU2401095189 Hamburg DER SPIEGEL in German
23 Jan 89 pp 24-25

[Unattributed report: "Up to the Border Everything Is Harmless; FRG Nuclear Industry as Supplier for Military Nuclear Programs"]

[Text] Forty years of the FRG—40 years of dispensing with nuclear weapons. By signing the European Defense Community Treaty in 1952 and the Nuclear Nonproliferation Treaty in 1969, the FRG solemnly renounced the "further proliferation" of weapons of mass destruction. The vow was not observed for a long time.

The rapid development of the FRG nuclear program paved the way for a competitive international nuclear industry. Officially, exports of nuclear plants to all parts of the world, such as Argentina, Brazil, Iran, India, South Africa, or the USSR, always served the "peaceful use of nuclear energy." However, FRG nuclear know-how no longer helps to produce only kilowatts but also kilobombs.

In the European Urenco firm in the Dutch city of Almelo, a Pakistani scientist pocketed plans for a uranium enrichment plant in 1975. In the following years all the components for a Pakistani copy of a reactor were bought from some 120 firms in Western Europe. Through the Freiburg-based CES-Kalthof GmbH Engineering Office, FRG companies also received several major orders. Stuttgart Team-Industries supplied frequency transformers, the Singen Aluminium-Walzwerke [Rolling Mills] supplied aluminium rods, Hanau Leybold-Heraeus supplied vacuum pumps. All these components were so harmless that they did not even require an export license from FRG authorities.

According to the findings of the U.S. administration, material for the production of nuclear bombs has been produced in the Pakistani Kahuta nuclear research plant since 1984. Albrecht Migule, a dealer in nuclear materials from Freiburg and owner of the CES-Kalthof GmbH Engineering Office, was given a suspended sentence of 8 months' imprisonment and fined DM30,000.

As early as 1969, Bonn concluded a government agreement with Argentina on nuclear cooperation. A year earlier, FRG reactor constructing companies managed to receive the first export order for a heavy water reactor despite stiff competition. In 1974, the Atucha I [Roman one] reactor went into operation.

With the support of Muehlheim Kraftwerk Union (KWU) [Muehlheim Power Plant Union], which today comes under Siemens, a pilot reprocessing plant was set up in Ezeiza near Buenos Aires. Finally, in 1983, the Argentine Government surprisingly announced that it had an enrichment plant, which had been considered to be secret before—annual production: 500 kilograms.

Helmut Hirsch, from the Ecology Group Hannover and author of a detailed study on Bonn's "Nuclear Policy for Power and Profit," writes: "The know-how acquired from the FRG could be fruitfully applied in all these nuclear plants."

Originally, a total of eight KWU reactors from the FRG were projected to be built in Brazil as part of a gigantic nuclear pact. While because of a lack of funds the extension of Angra 2 and Angra 3 power plants was delayed, good progress was made in sensitive plants. As early as 1985, initial operational tests could be carried out in the Resende enrichment plant. Some 450 nuclear experts from Brazil were trained in the FRG.

In the meantime, Brazil has itself become an exporter of nuclear plants, for example to Iraq. The Nukem firm of

Hanau also supplied Iraq with "hot cells" for the remote-controlled handling of radioactive material in 1979. Iraq, whose Osirak research center was destroyed in an Israeli air raid, is a signatory to the Nonproliferation Treaty. Experts from Siemens/KWU are currently preparing the extension of two nuclear power plants for Iraq's former wartime opponent, Iran. The nuclear site in the Iranian city of Buschehr was mothballed during the Gulf war.

Without FRG help, the nuclear fire would also go out in Egypt. In April 1984, KWU concluded a consultancy agreement with the nationally developed, failure-stricken Tarapur power plant. The German helpers were not reluctant to supply nuclear equipment, which the United States had refused after the first testing of an atomic bomb on the Indian subcontinent.

According to statements in the nuclear investigation committee in Bonn—which were made by former manager Alfred Hempel, a nuclear merchant from Duesseldorf—he later "sold 200 to 300 tons" of heavy water to India and Argentina. Through his Swiss mediator company Orda, Hempel also delivered material to the RSA.

The most delicate nuclear deal of German industry is being done with the RSA. South Africa is the FRG's main supplier of uranium from the mines of neighboring occupied Namibia. As far back as 1974, the Steag concern from North-Rhine Westphalia cooperated with the Uranium Enrichment Corp. of South Africa for the construction of an enrichment plant.

A year later a test plant went into operation in Balindaba near Pretoria. The FRG companies Siemens and Messerschmitt-Boelkow-Blohm are reported to have supplied the necessary separative elements [trennelemente], the Gutehoffnungshuette concern the compressors, and Leybold-Heraeus the valves. However, the companies in question deny any involvement in the high-tech nuclear project.

Nuclear deals between the NTG firm in Gelnhausen, Hesse, and the RSA are undisputed. The highly controversial Nukem company from Hanau was a shareholder in the Transnuclear South Africa company until last year.

On 22 September 1979 the first South African nuclear bomb exploded above the Indian Ocean.

Human Error Cited as Cause of Biblis Incident
51002416a Munich SUEDEDEUTSCHE ZEITUNG
in German 10/11 Dec 88 p 3

[Article by Klaus Brille under "Biblis Nuclear Power Plant: Reconstruction of the December 1987 Incident" rubric: "The Shove Toward Disaster: Experts Still Dispute How Close the Rhine-Main Region, With Its 2.5 Million People, Came to a Core Meltdown"]

[Text] Wiesbaden, 9 Dec—This much is now clear after these turbulent days: The error was in the human factor.

The human factor in large-scale technical machinery is that which is human about people: they forget or sometimes overlook something, they hesitate, they sometimes test things, they get angry, they console themselves, they deceive themselves, and they make mistakes and are not eager to admit these mistakes, especially when they result in unpleasant consequences of a personal, financial, social, or political nature. "To be sure, it is not good to be forget," said Director Meyer, for example, "but it is certainly human."

No one would dispute that if Mr Meyer were not director of the nuclear power plant in Biblis and if the downright human factor had not shown its face precisely there in such a way that Hessen's environmental minister sees himself obliged to direct the Bavarian Association for Technical Inspection (TUV) and the Society for Reactor Safety to make an inspection that expressly deals with the human factor. The later it gets, the more urgent is the question, namely, of whether and how close the Rhine-Main region with its 2.5 million inhabitants came to a nuclear disaster a year ago.

Anyone who attempts to get to the bottom of this question will be strongly confronted with the human factor. It is hard to find the truth where people are involved. The wisdom of the experts is full of contradictions and their technical jargon is disheartening. But now that more and more details are reaching the public, it is possible, roughly at least, to find out how the human factor appeared a year ago in the control room of Block A of the nuclear power plant in Biblis, which has been in operation for 14 years.

Forgotten and Overlooked?

Thus, on 16 December 1987, in starting up the plant again after a stoppage caused by a leak in the secondary circulation, the reactor operator "forgot a switching operation," as Director Fred Meyer said. One of a very large number of lights on the control panels indicated (and the computer registered it) that a certain valve that should have closed was not closed. Forgotten, overlooked? In the Hessian Environmental Ministry, the responsible supervisory authority, the incident was later noted as a "misinterpretation of a signal (valve open) as an indication error." And Federal Environmental Minister Klaus Toepfer reported on Wednesday in the environmental committee of the parliament that the operating personnel had already noticed the defect and attempted to close the valve "by again raising and lowering it," for this had been successful in the past. Obviously, then, the reactor operator believed that the signal light was defective and that the valve was actually closed; according to Christian Rettweiler, chairman of the work council at Biblis, he may have thought: "Aha, there must be an end contact error that ought to be looked into later." But there was no inspection; nor did the colleagues in the next shift notice the error.

The result was that the indicated light was warning in vain for about 15 hours. Not until that night did the third

shift get to the bottom of the matter. To be sure, it was in a different way, namely, "in the course of the checks that were carried out as a result of the temperature rise in the gravel bed filters for the coolant purification (report at 0303)" (according to a later report by the Reactor Safety Commission. After consulting with the block leader at 0516, the night crew then began—what their colleagues should have done earlier—to "shut down" the plant. Meanwhile, with a trick they also sought to make the indicated valve close and Toepfer was not the only one to perceive this as "especially serious."

One may now wonder why the crew resorted to this trick, which, in the words of Undersecretary Manfred Popp from the Hessian Environmental Ministry, did not represent "any measure foreseen in the operating manual." One probably ought to consider that, as a number of experts as well as work council chairman Rettweiler say, one generally gives a valve "just a little push" by means of pressure compensation "and then the valve does close." Obviously this has already been practiced in Biblis as well, the only question is whether it was at some other point or also at this very critical point.

That fatal valve, namely, as one of two so-called stop fittings, is located on a line that links the primary circulation under high pressure (that is, the cooling pipes filled with radioactively contaminated water directly at the reactor core) with the so-called core emergency and additional cooling under low pressure, and these fittings have the extremely important task of strictly separating these two systems in full-load operation. Of decisive importance thereby is the fact that the additional cooling system, in contrast to the primary circulation, is partially outside the so-called containment, that gastight sealing steel safety container that is supposed to keep the radioactivity away from the so-called annulus of the reactor building and the outside world. Thus, the place where the human factor came to bear at Biblis is one of those highly dangerous transitions from the containment to the external world.

The fact that the night crew now sought to give that one questionable valve a shove, in a manner of speaking, in that they opened a so-called test line that branches off between the two stop fittings just a crack for a few seconds for the purpose of lowering the pressure, had results: radioactive steam escaped from the relief valve outside of the containment into the annulus and from there filtered through the chimney to the sky; in addition, a so-called blow-out line was damaged. According to the authorities, what reached the open sky was well under the allowed limiting values. But this is not the ticklish issue here. Rather, the decisive question is: "What would have happened if this briefly opened test line could not have been closed again immediately because of the high pressure from the primary circulation?"

"If that had remained open, then someone would have gone to it," says Wolfgang Hauck, the main department head responsible for the RWE [Rhine-Westphalian Electricity Works] in Biblis. That means that someone would

have gone there and closed it by hand, even though the problematical slide valve of the test line is still in the containment. The Federal Ministry for Environment believes, on the other hand, that in such a case "there could have been a failure of the low-pressure lines." The Reactor Safety Commission likewise believes "that with the admission of hot primary coolant the test line could fail." In plain English: The pipes could have burst, and the radioactively contaminated water from the primary circulation could possibly have escaped the containment in larger quantities and thus—what is most important—no longer be available to cool the reactor core. And this is precisely the point where the question arises: "Could this have led to a core meltdown, to the Maximum Credible Accident (MCA), as once happened at the American nuclear power plant in Harrisburg?"

This is a case with which the experts are acquainted from a study as an "interfacing systems loss-of-cooling accident" (LOCA). It was precisely under this hypothesis that it was discussed in the Nuclear Regulatory Commission (NRC) after, under the seal of confidentiality, Wiesbaden and Bonn had transmitted the facts to the committees of experts, the operators of power plants, the other federal lands, and the international nuclear authorities. And this is exactly how it was handled by the U.S. trade service INSIDE NRC, a branch of the technical journal NUCLEONICS WEEK, which made the whole affair public. According to the report, the NRC experts view the Biblis incident as a possible precursor for such an "interfacing systems LOCA." This is also exactly how it is assessed by the experts of the Ecological Institute in Darmstadt, who look with disfavor on the use of nuclear energy. In the opinion of the Darmstadt physicist Michael Sailer, "only a few more operational errors would have been needed to trigger a core meltdown accident." Federal Environmental Minister Toepfer says that the little trick of the night shift could "under improbable, to be sure, but certainly conceivable circumstances...have led to a serious incident." If there had been a failure of the indicated test line outside the containment in front of the stop fittings also located there, then "extraordinary corrective measures would have been necessary to be able to regain control over the plant in this particularly serious case."

What, however, is the situation with respect to the emergency and additional cooling system, which would have been activated if cooling water had been lost? Former nuclear manager Klaus Traube, now critical of nuclear power, considers this system's reservoir to be limited. In addition, Bernhard Fischer, ecological researcher in Darmstadt, points out that the emergency cooling system is located in precisely that annulus that in the assumed case would be flooded by the water streaming out of the test line. Would this not have impaired the emergency cooling system at some point? "That question is justified and one must look into it," says Heinz-Peter Butz, spokesman of the Society for Reactor Safety, in this connection. "Our side has no calculations or ideas." From his point of view, such a case has "not arisen at all." "That is only taken as a reason to develop such a

chain of events." And, with an undertone of displeasure about all the theoretical discussions now circulating: "If one thinks ahead far enough, one always comes to a serious incident."

'Just One More Mistake...'

There has been further thought, including with respect to that fatal valve that started the whole thing. As was said, it was one of two stop fittings inside the containment that are suitable for high pressure, the second of which fulfilled its function. But what would have happened if the second had also failed? In that case, says RWE's Hauck, then there would have been two more valves directly on the containment that, to be sure, normally only have to stand up to lower pressure.

According to Toepfer, the Bavarian TUV, entrusted with drawing up an expert's opinion as early as 23 December of last year, comes to the conclusion that a failure of the second stop fitting "could have led to a leak to the outside that could not be stopped and thus to an uncontrollable incident." Nuclear critic Klaus Traube also sees it that way: "Only one more mistake would have been necessary, only one more improper operation or the technical failure of a valve, and then we would have been very near the great disaster."

These are suppositions, according to RWE's Hauck. In his words, the real situation was even miles away from being such that the plant would have shut down immediately—in the case of a larger loss of coolant, for example. In the opinion of the RWE, therefore, there can be no talk of the danger of a MCA. The human factor, the technical factor: what would have happened if, unfortunately, is something that one could know exactly only when it is already too late.

Error Seen Inevitable With Complexity of Reactor Systems

5'002412 Hamburg DER SPIEGEL in German
12 Dec 88 pp 92-93

[Article by Klaus Traube: "Human Error Is Built In"]

[Text] The statements made by the various official nuclear-power overseers following the disclosure of the accident at Biblis all included the message that the incident could be attributed to "human error." The message was well received. Published opinion displayed an allergic reaction to this human "failure" at the Biblis power plant. The guilty parties had been found, and the technology involved was exonerated.

On the day after the incident came to light the chairman of the reactor safety commission declared that a catastrophe like that at Chernobyl was "physically impossible" in reactors such as the one at Biblis. The federal minister for the environment concurred in saying that

the situation had been "far removed" from "the conditions in Harrisburg," the hitherto most serious reactor mishap in the United States.

There, as in Biblis, a decisive element in the accident was the fact that the personnel had not noted the unusual setting of valves (two improperly closed gate valves and one safety valve wrongly open because of a defect). And as in Biblis, at that time in 1979 the verdict was also: Human error.

The report of the fact-finding commission appointed by the U.S. President established "human error" as being to blame, so that "the true causes of the accident" were "not known." The authors describe the control room of the nuclear power plant: It can "make a downright frightening impression, with the communications that keep coming in over the loudspeakers and the control panels with their red, green, amber, and white signal lights. Plus the alarm systems, which are sending more than 100 acoustic or optical signals per hour."

It is within this milieu that the operating personnel must be responsive. There are the additional facts that signals frequently cannot be unequivocally interpreted and false alarms are not uncommon—something that played a role then in Harrisburg as well as now in Biblis.

The organizational sociologist Charles Perrow, who was called in as an expert by the U.S. fact-finding commission reported:

"The operators testified before the fact-finding commission that in view of the hundreds of valves that must be opened or closed in a power plant it is not unusual for a few of them to be in the wrong positions..."

Perrow furnished evidence that the operators in Harrisburg were by no means humanly able to correctly decipher the multitude of signals that crowded in upon them in this unusual accident situation. In a comprehensive investigation of the causes of industrial disasters Perrow came to the general conclusion that: In connection with accidents in highly complex technical systems, almost always human actions play a significant role—actions that seem inexplicable at first and are in any case unpredictable but upon closer analysis frequently turn out to be quite reasonable subjectively, even if objectively wrong.

For that reason alone the current dividing of causes of accidents into equipment-related and human failure is misleading: In highly complex systems such as nuclear power plants so-called human error is built in, so to speak, even though the occurrence of such errors cannot be predicted in a particular case.

Last Monday the director of operations of the Biblis power plant publicly countered the charge of "error" by the

personnel with the comment that "in the deluge of the hundreds of signals" at the starting up of the reactor, the display indicating the open valve had not been noticed.

In fact, if the operating personnel were to investigate immediately and carefully every possibly suspicious signal, the resulting interruptions in operation of these enormously expensive nuclear power plants would probably be too costly to be endured. Even the later attempt of the Biblis personnel to eliminate the trouble by "jogging" an auxiliary valve—a routine procedure for loosening stuck valves—is explicable in view of the prevailing pressure to produce. Had the jammed valve flap then closed as expected, the power plant would have soon been "on-line" again.

The supervisory authorities and experts have internalized this pressure to produce as well: Apparently during the months' long investigation of this shattering incident nobody demanded that the power plant be shut down in order to study the defective isolation system and to keep it shut down until the operating manuals were definitively corrected—a self-evident course of action in the view of an official of the American supervisory agency, according to NUCLEONICS WEEK.

The Harrisburg fact-finding commission noted: "The most dangerous 'conviction' of all is the general preconception that such a facility is safe in a mechanical sense. This leads to a disregarding of the human component in nuclear power plants."

Was it not perhaps the case that the operators at Chernobyl were convinced of the safety of the power plant when they disengaged the automatic reactor protection system? Is not such a thing possible under conditions in Germany? At the Brunbuettel nuclear power plant, during the investigation of a serious accident in 1978 it came to light that the operating personnel had put one leg of the automatic reactor protection system out of operation, contrary to strict instructions, in order to avoid costly and annoying interruptions of operation.

Because of the experiences imparted by their daily routine the operators involved are likely to have been simply not fully aware of the dangerousness of their activities. The people operating a nuclear power plant by no means feel this is a disaster-prone facility. Although they witness malfunctions year in and year out, still there have been no catastrophes, either at their own power plant or at the other plants with which they exchange experiences, except at faraway Harrisburg and Chernobyl.

Such a routine leads to a subjective (but objectively erroneous) feeling of safety, which in the course of time lures the operators into careless actions.

Moreover the "general preconception that the facility is mechanically safe" is also brought about not least by the

risk analyses, which put the accident probability for a core melt down of nuclear power plants within the range of "once in 10,000 reactor operating years," and even then it is calculated that there would be only relatively limited consequences.

Such figures about the probability of occurrence and about the consequences of reactor disasters are nonsense with scientific padding. Due to the great technical complexity of nuclear power plants, the possibilities for combinations involving various mechanisms of equipment-related failure and human mistakes are almost unlimited and therefore are not completely ascertainable—let alone quantifiable—in terms of mathematic models, no matter how ingenious these may be.

Of course, such risk studies do not consider the bypassing of reactor protection systems as at Chernobyl or even at Brunsbüttel, not to mention sabotage or enemy action. Not even the seemingly extremely improbable sequence of mistaken actions taken at Harrisburg could be covered by the first American risk study that appeared a few years previously.

Such quantifying of the probability of occurrence and the consequences of nuclear power plant disasters by means of risk studies, by "proving" the harmlessness of nuclear power, gives support to that same "most dangerous conviction." It is the basic reason why the head of the PreussenElektra company was able to declare following the catastrophe in Chernobyl that: "If at our own nuclear power plants we were not able to rule out the possibility of an accident having such a massive escape of radioactive materials as happened at Chernobyl, we would not operate these facilities any longer."

"We can rule that out"—that was the official line after Chernobyl. In a talk with DER SPIEGEL the head of the Kraftwerk Union even categorically denied that there could be fatalities or extensive evacuations after an accident at a German nuclear power plant.

Now on Wednesday of last week the federal minister for the environment qualified the initial assessment of the Biblis accident he gave on Monday. He reported to the environmental committee of the Bundestag that in Biblis a "serious" situation had been "conceivable." Put into plain words, this situation would have been that of an open pipe from the reactor to the outside world, resulting in the release of enormous amounts of radioactivity—as at Chernobyl.

Accordingly, for the time being "we can rule that out" is surely an unsuitable expression. What will the next official line be?

Expert Interviewed on Nuclear Reactor Safety
51002416b Munich SUEDEDEUTSCHE ZEITUNG
in German 13 Dec 88 p 8

[Interview with Prof Adolf Birkhofer, chairman of the Reactor Safety Commission, by Christian Schuetze: "There Is No Fully Automated Reactor: Were We Facing a Disaster in Biblis? Safety Technology and Risk Awareness Must Be Developed Further/International Lessons"; date and place not specified; first paragraph is SUEDEDEUTSCHE ZEITUNG introduction]

[Text] The reactor incident in Biblis A, which became known in the FRG by the roundabout way of an American technical journal, has disturbed the public—not so much because of the incident itself as because of the information practice, the classification of such incidents, and deficiencies that have now become clear in safety technology and the risk awareness of operating personnel. Prof Adolf Birkhofer, chairman of the Reactor Safety Commission, has expressed himself to the SUEDEDEUTSCHE ZEITUNG on some problems that have become apparent. Christian Schuetze spoke with him.

SUEDEDEUTSCHE ZEITUNG: What happened in Biblis, how did you find out about it, and how did you make it public?

Birkhofer: In a nuclear power plant, the high-pressure circulation is separated from the low-pressure circulation by two stop fittings arranged in tandem. They represent a barrier to prevent the penetration of high pressure into the low-pressure part in the event of a breakdown.

SUEDEDEUTSCHE ZEITUNG: But through an unclosed valve, precisely this penetration took place. What could have happened?

Birkhofer: During the shutting-down process, when the output of the reactor was slowly reduced, the personnel seeks, by opening a valve in the test line behind the unclosed valve, to reduce the pressure, so that the then relatively higher pressure in the high-pressure part could shut the valve. A throttle for a substantial reduction of the flow is mounted in front of the valve in the test line. Primary coolant now got into the test line under high pressure and thus got outside of the steel spherical container and into the annulus between the container and the reinforced concrete structure. A relief valve in the annulus responded. This resulted in a brief release of radioactivity, which was indicated and the personnel alerted. The fitting was again closed within a few seconds. It is designed very reliably; the probability that it would no longer shut is very slight.

SUEDEDEUTSCHE ZEITUNG: But if it had nevertheless failed?

Birkhofer: Then coolant under high pressure would have streamed into the line designed for 45 bar. But we know that these lines have a very high safety margin; the analyses of the Society for Reactor Safety—GRS—show that a failure of the line is not to be expected even at 100 bar.

SUEDDEUTSCHE ZEITUNG: And how high was the pressure in this case?

Birkhofer: By opening the relief valve, a pressure of between 10 and 45 bar was probably achieved. If the personnel had not acted and if it had not come to a blowing out of the coolant into the annulus, then the reactor safety system presumably would have responded after a few minutes. In addition, an order would have been issued to close two fittings upstream from the relief valve. The test line could have been closed regardless of the failure of the first fitting. To be sure, these two fittings are likewise not designed for high pressure but they have high safety reserves. If, on the other hand, a lot of coolant had entered the annulus over a long time, then this, if the personnel take no action, could have led to very serious consequences.

SUEDDEUTSCHE ZEITUNG: Much radioactivity would have been released.

Birkhofer: Yes. And if one were not successful in compensating for the loss of coolant by introducing boric water into the primary circulation, then there would have been a lasting shortage of cooling for the reactor, conceivable to the point of meltdown.

SUEDDEUTSCHE ZEITUNG: Boric water for the capture of neutrons.

Birkhofer: To capture neutrons and for cooling. There would be cooling possibilities through the multiple high and low-pressure systems. One must consider, however, that, through the prolonged injection of hot primary steam into the annulus, cooling pumps could be damaged by heat and moisture. One ought to look into this question in detail. In my opinion, the chances were good that in this case the pumps would have done the job. By the way, there was still the possibility of introducing boric water into Block A from the neighboring block through the so-called emergency system. The Reactor Safety Commission called for the emergency system at the beginning of the 1970's.

SUEDDEUTSCHE ZEITUNG: Why did the flap trap fail, which represents a simple technical principle?

Birkhofer: The subsequent review showed contaminants that resulted in an incomplete closing of the flap.

SUEDDEUTSCHE ZEITUNG: Through improvisation and measures not covered by the operating instructions, the personnel sought to force it to close. They relieved the low-pressure part to give a shove to the high-pressure part—a risky maneuver.

Birkhofer: Quite right, a doubtful maneuver. And this is where we have to start. In my opinion, the personnel did not have the conceivable danger in mind; they had no right to open this fitting.

SUEDDEUTSCHE ZEITUNG: Is this not a training error? Such a team must, after all, know that when a low-pressure system is already linked with a high-pressure system the risks are even greater when they raise the pressure even further.

Birkhofer: Even though I believe that the personnel were convinced that the valve in front of the test line could be closed again any time. There should be no such manipulation. In its position on the safety situation of all German nuclear power plants, the Reactor Safety Commission RSK also pointed out the problem of training.

SUEDDEUTSCHE ZEITUNG: When was that?

Birkhofer: In 1986, we were entrusted with checking safety and, in November 1988, the RSK presented its final report, which has now been published.

SUEDDEUTSCHE ZEITUNG: It came too late in the case of Biblis. The training problem is not new. As early as the 1970's, there were publications that indicate deficiencies.

Birkhofer: I cannot remember any such deficiencies. We in the RSK had always insisted that the simulators—on which fundamental elements of training take place—always be adapted to the latest models. The training opportunity always allowed a qualified schooling. Operational experience generally shows that the training is good. But that does nothing to change the fact that mistakes occur again and again. For this reason, the principle is that technical facilities must ensure that operating errors remain without effect. The RSK has recommended that the training—and that is perhaps new, relative to the 1970's—extend beyond the failures that are the basis for the design of a reactor. In the training, they are also asked: What could have happened if this and that safety system had also failed?

SUEDDEUTSCHE ZEITUNG: Do the operating instructions have a model for incidents or failures that determines what has to happen in a particular incident?

Birkhofer: Our facilities are so equipped that in a malfunction automation will take over operations for 30 minutes. The personnel observe whether the measures triggered by automation are functioning properly. For this purpose, they have flow charts in the operating manual that set forth exactly what must occur in a particular malfunction. Under some circumstances, there are also prescribed measures by personnel to ensure that a malfunction can be controlled in the long term. If a great many trouble reports come together suddenly, this approach may be difficult, because then one can no longer recognize the primary cause. There

were, therefore, demands that other ways of thinking be tried. The safety status of a reactor can be described through a few clearly defined parameters: there must be enough water in the primary system. The reactor must be shut down. It must be possible to carry off the heat. These three objectives can be clearly defined through a few measured values, so that the personnel can then, if they are not able to follow the event flow charts, switch over and proceed "according to symptoms," in that they take measures that are no longer aimed at eliminating the trouble but at protecting the reactor.

SUEDDEUTSCHE ZEITUNG: There will be no fully automatically secured reactor?

Birkhofer: In my opinion, there should not even be such a reactor. It would be secured only against incidents that can be conceived in advance. If there are combinations of malfunctions, however, that were not conceived in advance, then the automation would hinder their elimination or control. Man must intervene here to supplement automatic operations in the long term. This requires enormous training and understanding of the scenarios that can occur when safety systems fail.

SUEDDEUTSCHE ZEITUNG: Are the combination possibilities of conceivable malfunctions quite large?

Birkhofer: They are very large.

SUEDDEUTSCHE ZEITUNG: So that one cannot store them all in a computer, which then always gives the right commands?

Birkhofer: With the help of expert systems, we at the GRS are in the process of storing the knowledge for an installation. But only to indicate that the malfunction could have some cause or other. I would not, however, advise using an expert system to decide what must be done. I would always allow the qualified person to decide.

SUEDDEUTSCHE ZEITUNG: What should the Biblis personnel have done?

Birkhofer: After they were warned that the first of the two stop fittings was not closed, they should have shut down the installation. They did do that later when other measurements showed that the valve was not shut.

SUEDDEUTSCHE ZEITUNG: An automatic system could recognize and correct the simple case of an unclosed valve. Why is there no such automatic system at this sensitive interface between the high and low-pressure areas?

Birkhofer: That is an important question. One could give thought to including the limit switch in the reactor safety system; then the reactor would be shut down automatically in the case of a fitting that does not close. We know of no problems with these flap fittings, which cannot be opened at / more even if there is an operational mistake at high pressure.

SUEDDEUTSCHE ZEITUNG: What was the nature of the contamination on the Biblis valve? Was it a large screw that got stuck under the flap.

Birkhofer: It was small particles that caused increased frictional forces, which made the valve stiff.

SUEDDEUTSCHE ZEITUNG: What conclusions are to be drawn? More schooling? More impressing of responsibility?

Birkhofer: In 1987, the advisory group of the general director of the International Atomic Energy Organization in Vienna proposed safety principles for all nuclear power plants. They were recognized worldwide. We coined the term "safety culture" for them. That means that all those who have to do with nuclear technology—supervising authorities and experts, and especially operators—must pay the greatest attention to reactor safety. Besides their high sense of responsibility, they must above all be even more open for the further development of safety technology. One may not simply blame the technician who has responsibility for the closing of the valve.

SUEDDEUTSCHE ZEITUNG: Safety costs money. Reactors are being retrofitted after the Biblis incident. Are improvements being undertaken without resistance or are the operators saying that safety is gradually becoming too expensive for them?

Birkhofer: The supervising authority ordered fundamental improvements very quickly after the Biblis incident. So that a latch prevents the test valve from opening, for example. We want to recommend other things to make operational errors impossible through changes in hardware. It would be good if the operators in Germany as well had a central installation dealing intensively with improvements in safety technology and its implementation. We could plan uniformly for everyone. Today technical discussions with the operators are to be carried out individually.

SUEDDEUTSCHE ZEITUNG: Are the operators resisting safety recommendations?

Birkhofer: They have not resisted things since Biblis. But there is always the problem that costly safety precautions against events with very low probability lead to long discussions.

SUEDDEUTSCHE ZEITUNG: Let us imagine that the Biblis incident had not occurred but that the Reactor Safety Commission had thought of it and called for precautions, for example the strengthening of low pressure circulation. Then there would certainly have been resistance.

Birkhofer: If the incident had not occurred, then it probably would have been difficult to put through measures against it out of the blue. Possibly the RSK would have raised further-reaching considerations in its new safety study. But that is speculation. Moreover, the first report came by way of the American technical magazine *INSIDE NRC* (stands for Nuclear Regulatory Commission) after the discussion with the OECD. But the report is false to the extent that one gets the impression from the description of the incident that the personnel had opened the second valve at the transition from the high-pressure circulation to the low-pressure section, which naturally would have been much more serious but technically impossible. Nevertheless, the report states: at no time was there a danger of a core meltdown. It was a matter of a precursor to a "postulated interfacing LOCA" (loss of coolant accident). "It was a matter of probability." An accident was not imminent. In my opinion, the probability that it could develop into a core meltdown was less than 1 in 1,000. The matter is remarkable from the point of view of safety technology, possibly significant as well, but it would have been wrong if I had said in the press conference that the disaster was imminent. There were still abundant possibilities for intervention and safety systems as well.

SUEDDEUTSCHE ZEITUNG: Did the personnel give thought to what should be done if their measures had not had any effect or had triggered something unexpected? One does not like to shut down reactors.

Birkhofer: It is a very experienced team. They had a good perspective of the plant. They thought that the warning light was giving a false indication; when they recognized that it was not, the reactor was shut down and its output reduced. But in addition to the wrong assessment of the signal, the personnel failed to inform the next shift; they should have done that, even if they believed that they were getting an indication error. One avoids a rapid shutdown, because it then takes longer to get the plant back in operation than when it is cut back slowly.

SUEDDEUTSCHE ZEITUNG: It is quite remarkable for someone to see a warning signal light up and say to himself: it is nothing, just a faulty light.

Birkhofer: People always have this basic problem. Here it was a special problem, because, I think, there had already been indication errors. We have already experienced a number of times in nuclear technology that one develops a picture of the situation and then negates warning lights when they contradict this picture. People are never impartial and they never completely trust instruments.

SUEDDEUTSCHE ZEITUNG: The personnel got the picture "normal course of events." The warning light shown into it. How could they disregard it? If, in driving a car, someone suddenly sees the warning light "oil pressure too low," he does not say "everything is all right, it is still running."

Birkhofer: But when you have experienced the oil pressure warning several times in your car and the oil pressure was really normal, then the next time you think: "It will be another false indication." That is, to be sure, unforgivable but it happens. I believe that there had already been several such false warnings in Biblis.

SUEDDEUTSCHE ZEITUNG: But then it would be better to look into the matter than to get used to the fact that warning lights are meaningless.

Birkhofer: Precisely so.

SUEDDEUTSCHE ZEITUNG: Mr Klaette from RWE has assumed that professional jealousy was behind the initial publication in an American journal. Do you consider that possible?

Birkhofer: I do not know whether it was by intention or lack of special knowledge. All I can do is cite *INSIDE NRC* once again. The head of the American approving authority said there that he sees nothing at all alarming in the Biblis incident and is not concerned by the fact that the NRC did not learn about it sooner. Murley did not assess the event as alarming. For this reason, I do not think that commercial interests were involved. Just as I wanted to do, the NRC has taken the incident as an occasion for an internal discussion about whether there are adequate precautions in the United States against the ingress of high pressure in low-pressure systems.

SUEDDEUTSCHE ZEITUNG: We spoke about the absence of a central planning unit for safety improvements.

Birkhofer: We also lack the kind of central clearing office in research questions that they have in the United States.

SUEDDEUTSCHE ZEITUNG: The minister who is now getting a Federal Office for Radiation Protection could also have a Federal Office for Reactor Safety, where improvements could be planned ex officio.

Birkhofer: The federal minister for environment also has a department for reactor safety in the Radiation Protection Office. The safety supervision will thereby be strengthened but in evaluating technical circumstances the authorities should always resort to additional expertise. The governments then decide which of their recommendations are to be applied in permits or requirements.

SUEDDEUTSCHE ZEITUNG: At the beginning of the discussion about the Biblis incident, the operating firm refused to provide information, referring to operational secrets. Should one be allowed to keep any operational secrets with respect to safety questions in nuclear technology?

Birkhofer: One should not and I act as though there are none. The trade law, however, requires restrictions. We always receive all reports on incidents but are allowed to pass them on to international organizations only with the consent of the operators.

SUEDDEUTSCHE ZEITUNG: At best the reactor construction firms were likely to be interested in keeping operational secrets about technical details, not the operators.

Birkhofer: I think so too. The publication practice is, by the way, quite varied. Events in Bavaria are frequently published, in the *SUEDDEUTSCHE ZEITUNG* as well. Many electric supply companies are more reserved for reasons that I do not understand.

SUEDDEUTSCHE ZEITUNG: You have been accused of being part of a cover-up and concealment conspiracy. Did you have an interest in keeping the incident covered up?

Birkhofer: On the contrary. When I found out about the incident in the spring, it was clear to me that it involved a substantial human failure. For this reason, I urged my colleagues to check the incident carefully and to investigate it for transferability. I discussed the incident in the Reactor Safety Commission and pointed out the special importance of the human influence. At the request of the Federal Environmental Ministry, the commission then investigated the case in the course of the summer in a subcommittee. Because of its general importance, we proposed that it be discussed in an international framework, in the OECD. We wanted to see to it that people deal with this type of incident in other countries too and that personnel are trained to keep in mind the potential danger in test procedures as well. Then, in May and June, on behalf of the Federal Environmental Ministry, the GRS also informed all land approval authorities and all operators, expert organizations and Associations for Technical Inspection. They were supposed to check whether similar procedures are also technically possible for other reactors. In addition, on the occasion of a conversation about our risk study in the Hessian Environmental Ministry, I indicated to a member of the board of the RWE the improper actions that seemed incomprehensible from my point of view. I do not understand how someone can express the suspicion that I had anything to conceal. On the contrary, I saw to it that this event was handled in depth in the competent technical bodies. The question of information to the public should not be addressed to me.

SUEDDEUTSCHE ZEITUNG: But the information process has been very prolonged, although the GRS classified the case as "urgent," which is not how the operators saw it.

Birkhofer: The GRS recommended this classification; the government took it up. But it should be remembered that the ad hoc measures that are supposed to preclude such events in the future were taken as early as March, when the supervising authority ordered them. The general nature of the case, however, requires a careful analysis before proposing general measures, on which we are working.

Security Concept of Wackersdorf Recycling Plant Questioned

51002417a Hamburg DER SPIEGEL in German
19 Dec 88 pp 66-67

[Unattributed article: "Monstrous Danger—A New Risk Assessment of the Proposed Wackersdorfer Atomic Waste Facility Questions the Operator's Concept of Safety. In an Emergency, All of Europe Is Affected."]

[Tex.] The West German Border Guard (BSG) helicopter squadron is familiar with the destination area. Where CS gas and special police units are normally deployed against suspected antinuclear protestors, Chancellor Kohl and the new Bavarian Minister President Max Streibl approach the demonstration from the air. On the grounds of the controversial nuclear reprocessing facility (WAA—Wiederaufarbeitungsanlage) in Wackersdorf, they want to stress that the atomic waste facility will be of "national significance."

Wackersdorf is supposed to make West Germany independent in the domestic European market from the French atomic-waste processor in La Hague and from the English in Sellafield. Bonn has DM90 million available through 1991 to pay in damages in the Upper Palatinate community. According to Streibl, this project worth over DM9 billion is a "centerpiece of conservative policy" just like protection of the environment and wildlife.

What happens when a nuclear core fails is described in the WAA safety study "Secondary Risks" (Restresiko), which has not been published until now. The study was done under contract for Greenpeace, the environmentalist organization. The nuclear experts in the "Nuclear Group" used 57 pages to evaluate "event sequences and results" for several "serious accident" scenarios. Author Helmut Hirsch with sarcasm: "Reprocessing is dead certain."

Hirsch came to that conclusion after the lecture on the official Safety Report by the "German Association for the Reprocessing of Atomic Fuels" (Deutsche Gesellschaft fuer Wiederaufarbeitung von Kernbrennstoffen—DWK), which is building the atomic waste facility under contract for 12 German electric utilities. The atomic

experts criticize that "all the events and accidents" are handled like a "paper plant functioning properly," in which there are only "emergencies according to regulations." Concerning "quality assurance" in one of the most risky production stations, there are only "statements of intent" to be found.

Of course, German nuclear technology ranks among the best, even after the hushed-up Biblis disturbance. Nevertheless, there is no operating experience anywhere in the world with a facility configured for an annual capacity of 500 metric tons of atomic waste. Hirsch: "The DWK facility is in a fantasy world." According to the study, a disturbance in Wackersdorf would be routine:

- The operators want to practically "rule out" the possibility of releasing radioactive elements into the ground through the construction of staggered "safety barriers." Of course, even miniscule amounts which could make their way through cracks in the foundation would contaminate the groundwater in a broad surrounding area.
- DWK says the monitoring equipment for treated plant wastewater is "perfect and safe for operation." Water is contaminated as it is used in the complex "Purex" process, where reusable plutonium is separated from uranium out of the spent fuel. Certainly, in an emergency, this water would escape through the local stream, the Naab, via the Danube River to the Black Sea.
- DWK rates the 100 each filter bases for separation of plutonium and uranium as reliable, both in normal service and during a disturbance. Still, damage of a single one of these components can lead to a "severely critical accident" according to the Hirsch study.

In the "largely untested" (Hirsch) automation of the atomic facility, there is future risk—Wackersdorf, the Biblis of the coming millenium? Just as at the Hessian nuclear power plant, possible reactor operator errors can scramble the entire automatic safety systems. For the German reprocessing facility, "direct intervention" is planned at first for the repair personnel. Each entry into "hot cells" containing burnable, explosive and radioactive materials would lead to long shutdowns of the expensive facility.

For this reason, DWK is using a new construction method with remote guided modules. As a result, in order to prevent a greater risk of fire, the internal oxygen content must be reduced by addition of extra nitrogen. The atomic critics see this as precisely another risk: should a fire begin in one of the cells which have neither fire alarms nor fire extinguishing equipment, an "event would gradually build up into a catastrophe."

Even at 144° F, the gasification of the chemicals utilized can lead to explosion. Radioactive materials can then escape outside with the exhaust. Finally, in a third phase the tanks, the pipes, and the multiple "safety barriers" would break down—Wackersdorf would burn through.

According to the scientist's calculations, depending upon the weather conditions, such an accident would mean the contamination of a large portion of Europe and the legal limit of five centisievert of radioactive rays would be exceeded. At a "release height" of 1,600 ft and a ground wind speed of 13 mph, the nuclides from Bavaria would reach the French capital in a day. The WAA researchers illustrate on a map of Europe how the "fallout" and "washout" will still have an effect 50 years from now. The scientists base their information on data from the Bavarian licensing authorities.

In the opinion of the KWU chief and Siemens board member Klaus Barthelt, such "erroneous" arguments are supposed to "suggest a monstrous danger posed by the reprocessing facility." The atomic critics have found, though, that the plant owners operate with "false claims." For example, according to the DWK safety report, an earthquake registering six on the Richter scale would have no effect on the atomic facility, six being the "maximum" for the Upper Palatinate region. In 1062, however, there was an earthquake in the Regensburg area registering eight.

One "neglected risk" is, in the opinion of the atomic critics, a possible aircraft crash. In accordance with the Reactor Safety Commission, the nuclear factory can withstand "impact loads" from a crashing Phantom jet fighter-bomber. Other military aircraft such as the American F-111, F-15, "Eagle," and the A-10 "Thunderbolt II," which laid waste to a residential area in Remscheid in early December, have not been taken into account.

"The effects of conventional weaponry are not considered in the aircraft crashes," criticizes the study. Training ammunition, bombs, thermite firebombs, on-board machine guns or rockets would so severely damage the reprocessing facility, however, that it could come to the release of the "great nuclear potential" in West Germany. Critic Hirsch: "Then, good night."

The authors of the risk assessment have avoided coming to one conclusion. Instead, they point to the effects of the Chernobyl disaster on health, food and agriculture. The ecologists write, "An additional heavy burden for Central Europe is that the WAA is 600 miles closer (than Chernobyl)."

Recent Reactor Incidents Show Weakness of Security Systems

51002417c Hamburg DER SPIEGEL in German
26 Dec 88 pp 63-67

[Unattributed Article: "Utter Carelessness"]

[Text] New climax in the series of accidents at the atomic reactors: Brokdorf was running without working emergency generators, additionally developed security switches failed to function in Biblis—the reactor was shut down.

The inspection work at the Brokdorf nuclear power plant was purely routine. As has happened every month since the nuclear reactor on the lower Elbe went on line, technicians checked the four emergency diesel electric generators. In case of catastrophes outside the reactor such as an aircraft crash or great explosion, the generators are supposed to insure cooldown and enable the automatic shutdowns.

The almost routine inspection tour led to an unusual occurrence. During the check of the switching sequence, an electrician was able to move one of the switches too far, as the Kiel Minister of Energy Guenter Jansen (SPD) explained later. Preussen Elektra, the operating utility company, proudly noted that the technician's "warning lights" came on immediately.

The alarm set off thorough investigations. Federal Minister for the Environment Klaus Toepfer (CDU) wants all 25 West German reactors checked because something simply incomprehensible had been found (in Brokdorf): all four diesel engines were missing "important parts" ever since the reactor went into operation in October 1986. The generators would not have functioned in an emergency and could have created "enormous problems up to and including a core meltdown," according to Jansen.

During a power outage, the (diesel) engines are supposed to independently provide the steam generator with fresh water for cooling and are also to generate electricity. The indispensable lubricant was missing in a transmission component in each of the engines: the oil ran out. The engineers forgot to build in certain cover seals ("abschlussdeckel") in a support between the generator and the transmission.

This discovery at Brokdorf during the week before Christmas, just 14 days after the disclosure of the covered up event at Biblis in Hessen, shows how questionable the reliability is of the emergency systems which are supposed to reduce the risk to the public. For the first time, the danger of an event running out of control ("Super-GAU") was built in, partially due to the management. The installation error was discovered neither at time of acceptance by the operator and regulators nor during the monthly test runs of the diesel engines.

This "utter carelessness," in the reactor, as Jansen calls it, leads one to question the safety philosophy of the reactor operators, who in any case traditionally try to hide their problems first. A good dozen events of the second-highest level of emergency, Category E ("Eil"—priority), such as at Brokdorf, are reported year after year according to official statistics. Many of them are first made public much later.

At the Bavarian Gundremmingen reactor, for example, one of the 11 pressure relief valves could be opened, but it could not be closed again. The operations manager shut down the reactor by hand. The event of 8 August

1988 was just recently (December 1988) made known to the public through a report in the AUGSBURGER ALLGEMEINE, and was immediately dismissed as "irrelevant" by the plant director, Reinhardt Ettemeyer.

After hints of a "severe event" in the Lower Saxony "junk reactor" at Stade by Kiel's Minister Jansen, politicians and operators gave in to making a public confession 2 weeks before Christmas. An automatically closed valve on a fresh steam line caused a sudden shutdown of the turbine, which caused strong vibrations in the overworn lines—with the danger of a line break understood.

Four months earlier in Stade, a valve in the nonnuclear water supply system was broken off. After the incident was initially covered up by the authorities, the Lower Saxony Minister for the Environment Werner Remmers (CDU) initiated criminal proceedings against the operating utility. The trial was conducted behind closed doors for weeks.

The most recent Category E event happened on 18 December at the Lower Saxony atomic reactor Lingen II. Because of a wrong electrical control signal, the reactor's operating crew opened a relief valve on the primary cooling circulatory system. For 32 seconds, radioactive cooling water ran into a relief tank.

In a report on Biblis in early December, the American technical journal NUCLEONICS WEEK printed that this was an impressive example how the atomic industry and the political atomic lobby hide events. For 15 hours on 16 December 1987, the outside world was only protected by one barrier, the so-called second shield, from radiation emitting from the highly radioactive cooling water from Reactor Block A.

Precisely three shifts of operating personnel overlooked a warning light and did not notice that a valve, the first shield, was left open. Franz Mayinger, the Biblis expert on the reactor safety commission, speculated that this could have led to an event beyond explanation ("auslegungsbereichgreifend Stoerfall")—bureaucratic jargon for an event out of control similar to Chernobyl.

Since 21 December 1988, after a "supervisory discussion" between Hessen's Minister for the Environment Karlheinz Weimar (CDU) and the Biblis operator Rheinisch-Westfaelisches Elektrizitaetswerk (RWE), the powerplant has been shut down, at least until 3 January. The chief of the atomic reactor and Director of Block A has been "relieved of his duties until further notice" by RWE.

By the beginning of January, Weimar must report to the federal environmental minister and the Hessian court judge whether RWE as a powerplant operator still possesses the "reliability" required by the nuclear regulations. Beyond that, the Minister must determine whether his injunction has been carried out and when Biblis can go on line again.

The example of the calamity-prone reactor Biblis shows how the atomic community withholds information, because none of the "technical improvements" which federal Environmental Minister Toepfer hurriedly presented could guarantee that the old valves would not malfunction again.

And so the neighboring Block B of the Hessian reactor was shut down on 14 December, because of "little leaks" in the after-cooling system. The event was caused precisely by the new protective switches. They are supposed to make hand adjustments (which is what technicians on Biblis A did) on the test valve impossible as long as the first shield is open. Only after a control light shows the closing of the first valve will an electrical contact lift the block on the test valve.

Technical improvements have twice blessed the operators with problems. During tests in November, the test valve suddenly would not open any more, although the first shield was confirmed closed. Because of a defect in the first shield electronic monitoring system, false signals were sent to the test valve—the security switching proved itself unserviceable.

Given the ever new horror stories, opponents of nuclear power are drawing crowds again. About 10,000 demonstrators from 120 organizations protested in Biblis on 18 December against the awful threat: "shutdown—climb out—back up." About 83 percent of West German citizens believe that accidents in German nuclear reactors with severe results are possible.

Among the "many unidentified risks" in the nuclear industry, according to Jansen, is what can be seen again in Brokdorf and Biblis, and is an old familiar one: the human risk.

Presence of Tritium Interrupts Dismantling of Reactor

31002417b Munich SUEDEUTSCHE ZEITUNG
in German 21 Dec 88 p 17

[Unattributed Article: "Reactor Demolition Is Interrupted—Too Much Radioactive Tritium in Local Atmosphere—Unexpected Problems Delay Dismantling Work in Niederaichbach"]

[Text] During the demolition of a nuclear power plant in Niederaichbach near Landshut, the first such demolition ever in Europe, the dismantling of the moderator circulation system has been interrupted just a few weeks after its beginning. The Nuclear Research Center in Karlsruhe based the measure taken on Tuesday (20 December) on the appearance of local atmospheric contamination with radioactive tritium. Had the work continued, it was feared that allowable rates of exposure would have been exceeded.

Residue of 'Heavy Water'

The tritium apparently originated from the residue of the "heavy water" used as a "moderator." The heavy water has presumably been collecting in inaccessible parts of the moderator system since the shutdown of the Niederaichbach reactor 14 years ago. According to the Karlsruhe center, the contamination was so minor that even a 1-year stay in the facility would only expose a person to radiation levels much lower than the annual dosage allowed for people professionally exposed to radiation.

In the application for permission to tear down the facility, however, the complete removal of radioactive-contaminated water was specified. As a result, the tritium values were proposed and accepted. To continue the work, an application to raise the (allowable) exposure levels is being considered. Other facility components are not affected by the interruption of reactor demolition. As a result, it is anticipated that the actual removal work can be continued on schedule.

The 100-megawatt Niederaichbach nuclear power plant, which is relatively small, was built between 1966 and 1972 at a cost of DM232 million. Because of technical difficulties which appeared even in the start-up phase, the facility was shut down in 1974 after only 14 days of operation. Since then, the atomic reactor has been in a state of so-called secured enclosure. The demolition is expected to cost DM120 million, and has not been attempted for an extended period. The SPD and the Greens protested because of the fear of the release of radioactivity, but that was as ineffective as the neighboring property owner's protest, who had a suit before the Regensburg Civil Court.

Tritium is a Beta ray emitter with a half-life of 12.3 years. The crucial biological half-life for human organisms is a maximum of 500 days, according to information from Karlsruhe researchers. It is the nuclear fuel of future nuclear fusion reactors.

Containment Costs Could Force Closing of Older Reactors

51002413 Hamburg DER SPIEGEL in German
12 Dec 88 pp 95-99

[Text] Prof Adolf Birkhofer, chairman of the Commission for Reactor Safety, executive (president) of the Society for Reactor Safety (GRS) and holder of a chair for reactor safety at the Technical University in Munich, received Bonn's Minister for Reactor Safety in Cologne in October. In the GRS lecture room assistants to the nuclear pope projected illustrations, diagrams and curves onto a screen, and Birkhofer explained to Minister Klaus Toepfer the method and the result of the second part of his major risk study on the safety of German nuclear power plants.

His summation: Since submitting the first part, Phase A, in 1979, everything has improved greatly. At that time the calculations for the biggest nuclear accident, the meltdown of the highly radioactive nuclear core, were once in every 10,000 years per nuclear reactor. Birkhofer's new message after the conclusion of Phase B: the "event" was less probable now, an accident of this kind had to be anticipated only every 33,000 reactor years, and in 9 cases out of 10 there would still not be a catastrophe: the risk of that was only once in 500,000 years.

Then Birkhofer pleaded for keeping the good tidings under lock and key, for delaying its public announcement as long as possible. The reason is that there are some kinks in his figuring, no matter how carefully it has been worked out: The study concedes that:

—The 23 German nuclear power plants require substantial retrofitting, just in order to reach the state of technology that Birkhofer used as the basis for his optimistic calculations.

—In contrast to previous doctrine, the meter-thick steel and concrete containment for nuclear reactors would not hold out for 5 to 6 days in the event of a meltdown, and the 6-meter thick concrete slab for the reactors is not adequate to really protect ground water from radioactive contamination in the event of a extremely large nuclear accident.

This destroys some of the articles of faith of the German nuclear community; and, of all people, their proponent Birkhofer is the one who has toppled them.

In 1976, following the appearance of a risk study in the United States, when the Social Democratic Minister of Research Hans Matthöfer awarded Birkhofer's Society for Reactor Safety a contract to present a similar study for conditions in Germany, his real intention was to make nuclear energy acceptable. The professor was supposed to determine the "social risk" of nuclear electricity, which was considered theoretically small: Experts anticipated that as the result of German technology, the probability of an extremely large nuclear accident was smaller than in the United States.

Their hopes deceived them. German reactor builders actually came out looking a little better. But since the installations in Germany are located in more densely populated areas, Matthöfer's successor Volker Hauff was forced to announce: In the event of a steam explosion, 14,500 people would die immediately, 104,500 would succumb to the delayed effects of radioactive contamination. For the catastrophic event of a core meltdown—mathematically predictable once in every 2 million years—the study projected 5,100 instant deaths and 44,000 subsequent victims. However, 93 percent of all core meltdowns would not have these consequences, because the safety jacket of steel and meter-thick concrete would stand up to the pressure in most instances.

In 1979 it was already clear: Birkhofer's A Study, which followed the U.S. model, contained deficiencies which were supposed to be ironed out in Study B. With more refined methods the experts at the Nuclear Research Center in Karlsruhe (KfK), for example, were hoping for a dream result: only one core meltdown in 100,000 reactor years.

The numbers that the computers at the KfK in Karlsruhe and at the GRS in Munich spat out in 1987 and 1988 were not quite so rosy. Birkhofer and his risk expert Friedrich Wilhelm Heuser have substantially expanded the number of "events causing a breakdown"—for example, a fractured pipe in the cooling system or the loss of emergency power—and were still able to present Riesenhuber with an acceptable result: A core meltdown per reactor could be anticipated "only" every 33,000 years, unlike Study A which predicted every 10,000 years.

Still, Birkhofer and his experts do not derive much pleasure from their numbers. A new study indicates that there is a smaller probability of core meltdown accidents, but the probability of major catastrophes with thousands of immediate deaths and tens of thousands of later casualties is higher. The reason: the reactor dogma still sacrosanct in 1979, that the steel and concrete containment would resist the high pressures of a meltdown in 93 cases out of 100, is no longer valid.

The nuclear experts' trust in the integrity of the reactor containment was based on calculations from the reactor constructor Kraftwerk Union (KWU). Backed by these calculations, in September 1986, after Chernobyl, KWU head Klaus Barthelt delivered an "absolute" guarantee in a SPIEGEL interview (39/86) about the consequences outside the nuclear reactor for core meltdown accidents in German reactors:

"I rule out the possibility of deaths. I rule out devastated land, uninhabitable for any extended period."

Risk expert Heuser from the GRS echoed Barthelt a few weeks later at a convention of experts in Aachen. Two years later, on 4 November 1988, at the discussion held by GRS experts in Cologne, he corrected himself and conceded that "a core meltdown under high pressure can lead to an early failure of the safety container and thus to severe consequences from the accident."

The new finding is based on a GRS examination of the assumptions made by KWU. The experts' assumption is that in the event of core meltdown with high temperatures, the reactor pressure containment can only hold out for a few hours at the bottom end, then the gas will shoot out of the ruptured steel cylinder, as if from a rocket. The cylinder will tear loose from its mounts and, with enormous force, would shatter the steel and concrete containment. Huge amounts of radioactivity would be released, the catastrophe seemingly the inevitable consequence in almost every meltdown.

Birkhofer and Hans-Henning Hennies, the executive head of the Nuclear Research Center in Karlsruhe, were genuinely shocked by this result. If German reactors were so unsafe, Hennies blurted, perhaps the Greens might be on the right track after all. Birkhofer, who did not want to take the bad news to Bonn at all, complained that he did not want to be the "punching bag" all the time. So he looked into how to find a remedy.

It looks like this: Technical weak spots, which the risk expert discovers in his investigations and which are supposed to be corrected by the reactor operators, are considered to have been already eliminated in his study. That is the only reason Birkhofer reaches his relatively positive prognosis.

For example, if a prime steam pipe breaks and water vapor reaches the annular space between the reactor pressure container and the containment and damages the armatures and emergency pumps installed there, that is an "event causing a breakdown," which can lead to a core meltdown. At the cost of several million DM, the endangered installations can be converted so that they can hold up to the steam in future. The electricity producers' promise to proceed with the conversion is enough for Birkhofer—although the "weak spot" will exist for a considerable time. No GRS expert is willing to quantify how many improvements figured into reactor design have already been made, how many exist only on paper.

Following the same pattern, Birkhofer set out to eliminate major nuclear catastrophes using the computer—with the help of "accident management," active intervention after a breakdown has occurred.

An example: In a core meltdown—the uranium fuel rods in the radioactive primary loop are no longer being cooled if, say, the feed water pipe bursts and the backup cooling fails—there is about 1 and 1/2 hours time in which the water around the hot reactors gradually turns to steam. The core meltdown does not start until the fuel rods are exposed. Birkhofer does not intend to let events proceed as far as that: At the latest 1 hour after the cooling failure, the nuclear engineers in the central control room should be able to intervene, according to Birkhofer.

A nuclear power plant contains the radioactive primary loop, in which heat is generated through nuclear fission and water is heated, in a similar manner to an immersion heater. The heat is transferred by means of a heat exchanger into the nonradioactive secondary loop, which is tightly closed off from the primary loop, and there turbines convert it into electricity. If the heat removal process fails, temperature and pressure continue to rise in the reactor pressure container.

Pressure in the primary loop can be lowered if the operating personnel decides early enough to reduce pressure in the secondary loop and to bring water from outside to the heat exchanger, either from the reactor feed water reservoir or by using fire pumps. Then the

heat is removed normally, pressure in the primary loop drops, the fuel rods remain covered with water and the radioactive primary loop remains closed.

If this action is not successful, or if it is impossible for technical reasons, Birkhofer proposes opening valves in the primary loop as the last resort. When a nuclear power plant is operating normally, pressure in the reactor pressure container is 160 atmospheres. If this container is opened in a controlled fashion, pressure drops to less than 90 atmospheres; then water could be sprayed into the reactor core through special installations, the fuel rods remain under water, and a meltdown does not occur. However, the entire containment is contaminated by radioactivity, and the reactor is unusable.

Birkhofer is forging other weapons against nuclear meltdown. As the heat increases, hydrogen forms in the pressure container. If the hydrogen is enriched more than 4 percent, it is flammable. If the concentration becomes higher, the result can be dangerous explosions. Following the path of accident management, a critical development of this kind would be eliminated by various design innovations, such as introducing oxygen, by means of automatically unrolling "catalytic carpets" or with automatic self-igniters, which burn off the accumulations of hydrogen before it reaches a dangerous degree of concentration.

GRS expert Heuser promises that these kinds of tricks or installations would prevent completely 90 out of 100 otherwise unavoidable core meltdown accidents, another 9 would be converted from a high pressure meltdown to a low pressure meltdown. The advantage of this is that the safety container remains sealed, no radioactivity escapes to the outside and the engineers have time to harness the renegade reactor.

An acceptable figure can again be "estimated" for the still remaining probability of core melts (Heuser): under these conditions a "normal" meltdown occurs mathematically only once in 100,000 reactor years. The major nuclear catastrophe cannot be excluded entirely from a "probability standpoint" (Birkhofer), but, and this is the message, its likelihood is almost incalculable.

Birkhofer's beautiful figuring has one blemish, however: It ignores the factor of time. In order for the operating crews to be able to follow his advice at the critical time, the reactors have to be converted. The power plant operators do not want to let the construction crews start their work—if at all—except during a shutdown that is scheduled anyway in order to change fuel rods. Among the experts Birkhofer's estimate that German nuclear reality could be adapted to his mathematical assumptions is consequently considered to be much too optimistic.

In addition: Even accident management does not exist to the point of zero risk. If the automatic ignition system for burning off hydrogen switches on just a few minutes too late, it will cause the explosion it was supposed to

prevent. Acts of intervention in the operational sequence, which were considered sacrosanct until now, are now recognized as possible—a break with the previous philosophy of safety which relied on a highly sophisticated, multiple design technology. Birkhofer sees the conflicting goals: "What could not be thought before, must now be done."

Example: There is a valve on the reactor pressure container. If pressure rises above 164 atmospheres during normal operation, the valve opens; when the pressure drops to 156 atmospheres, it closes again. If there is the threat of a core meltdown, and if the engineers, following Birkhofer, are supposed to reduce the pressure, they have to interrupt the automatic operation and open the valve manually and keep it open in violation of all prior regulations, even if it wants to close again at 156 atmospheres. The necessary loss of pressure cannot be achieved in any other way except by this intervention.

Birkhofer's strategy also contains another risk. At least that is the contention of the respected U.S. expert Marshall Berman from the Sandia National Laboratories in Albuquerque: In the event of a core meltdown, the danger of a steam explosion, which is impossible at high pressure, increases at low pressure. And no containment, the experts agree, is protection against that.

But even if the step into Birkhofer's new nuclear world has been taken in the next few years, and his accident management works, his risk figures still do not reflect reality. The criticism of nuclear expert Michael Reimann, professor of thermodynamics at the Saarbrücken Technical University is that his safety building is based solely on experiences in the relatively modern Biblis B power plant and on analyses of an "idealized type" of this pressure water reactor. He said that in older pressure water reactors, such as Stade, it was questionable whether any improvement at all would be possible. Birkhofer was also unable to make any statement about the seven boiling water reactors from Würgassen to Gundremmingen; in their containments, which were smaller and weaker, "toughening up" would be more difficult, and a buildup of pressure would develop considerably more quickly than in the case of pressure water reactors. These reactors, which still generate almost 40 percent of German nuclear electricity, were the real problem cases.

Minister of the Environment Klaus Toepfer has realized this in the meantime, and Birkhofer is being awarded a new commission before the old one has been published: the risk professor's next project is to examine a boiling water reactor.

Whatever he produces, he will have a hard time convincing nuclear opponents and skeptics. The loss of credibility suffered by nuclear proponents as the result of scandals such as Transnuklear and Biblis A also attaches to the risk experts.

Until 1986, Birkhofer admits today, he traveled the country himself and proclaimed: Even if the reactor core melted through downwards, it would stop, at the latest, in the concrete of the 6-meter thick concrete footing slab, in fact after about 5 meters. About the time that, in reality, molten uranium was eating through Russian concrete in Chernobyl, the first results of his own analyses were available at the Nuclear Research Center in Karlsruhe: proof of the opposite. Now, in his B Study, Birkhofer has to take into consideration the previously excluded factor of radioactive contamination of ground water in evaluating the risk. He believes it can be controlled. Because ground water only moves ½ meter per day, there would be time for countermeasures; as in Chernobyl the power plant could be surrounded without undue haste with a concrete wall that extends down to the first non-water-permeable layer. "But" says Birkhofer, "I am not finished with that yet." He is examining whether his reactor safety commission will not have to recommend to Toepfer that all power plants have underground walls, and that would really cost the operators money.

If he comes to the conclusion that all reactors have to be converted or even have to be newly sealed off down to the ground water, are the authorities or then forced to revoke their permission to operate until the conversion has taken place?

Toepfer cannot take much more time with his answer.

On 21 January Birkhofer is paying a formal call on the man who commissioned the study, Minister of Research Heinz Riesenhuber, with his sound and picture show. Then publication can only be held back for a short time, Toepfer will have to declare himself.

Until now nuclear skeptics have not greeted his proposals to make reactors marginally safer with great joy. Every improvement was considered by them as proof that a lack of safety predominated. Toepfer has said: "I would like to get out of this dialectic loop."

But he is becoming more deeply entangled. If administrative judges hit upon the idea of making the higher safety standard envisioned by Birkhofer a required rule and therefore a prerequisite for permission to operate in accordance with the nuclear law, then nuclear reactors which have not been retrofitted would have to halt temporarily, others which cannot be retrofitted would eventually have to be taken out of service.

This threat is familiar to the nuclear community. In November 1986, under the shock of Chernobyl, nuclear expert Hennies from Karlsruhe pleaded vehemently for a new reactor containment design which "would hold back almost the entire radioactivity of large reactors in all conceivable accidents."

Obviously, Hennies continued in the November issue of the periodical NUCLEAR EUROPE, the problem of retrofitting existing reactors is scaring many people away from a strategy of this kind. "The price," according to Hennies, "could actually be that some older reactors would have to be closed."

Toepfer, the Minister for Safety, should demand exactly this price from the industry, without having to be forced to ask for payment by the judges.

UNITED KINGDOM

Explosion at Nuclear Weapons Establishment
51500057 London PRESS ASSOCIATION in English
1304 GMT 2 Dec 88

[Article by Jonathan Chapman]

[Text] An explosion shattered windows at the top secret atomic weapons establishment today.

A Ministry of Defence spokesman said there was a conventional explosion at the base in Burghfield, Berkshire, on a site where non-nuclear explosives were routinely destroyed.

No one was hurt and there was no radiation danger.

"There was no hazard to the public or personnel at any time," she said. Burghfield is believed to handle warheads for weapons such as Trident and Polaris.

It remains under MOD [Ministry of Defense] control although other royal ordnance factories were privatised over two years ago.

Labour Defence Spokesman Martin O'Neill called for an immediate inquiry into the incident which occurred just after 6 am and demanded a full statement from Defence Secretary George Younger on Monday.

"The veil of secrecy which surrounds activities at establishments like Burghfield has to be lifted when the public and the surrounding area have been disturbed and shocked by an explosion such as this," he said.

Miss Joan Ruddock, Labour MP for Deptford and chairman of the Parliamentary Campaign for Nuclear Disarmament, said the explosion was a matter for extreme concern and added: "I will not be satisfied that there has been no dissemination of nuclear radioactive material into the atmosphere until the government is prepared to give a full report detailing what happened."

CND chairman Bruce Kent said: "It is incredible that conventional explosives should be destroyed by burning in the middle of a nuclear bomb factory."

Uranium in Boeings 'Puts 250,000 at Risk'
51500055 London THE DAILY TELEGRAPH
in English 23 Dec 88 p 5

[Article by Roger Highfield, Science Editor]

[Text] In the worst type of air crash, 250,000 people could be put at risk by the substantial quantities of uranium contained in many Boeing 747s, it was claimed yesterday.

The hazards of the uranium carried by many U.S. civilian aircraft as counterweights were raised yesterday by Dr Robert Parker, a retired solid state physicist, in the magazine NATURE. "This material has been used with little public knowledge for more than 15 years and I would like there to be a discussion of that," he said.

It has been used to replace tungsten "which has the same density, roughly the same price but is benign. The question really is, why was depleted uranium substituted for tungsten for so many years?"

"But I regret that my article came out on the same day as the plane crash because it is likely that some will think there is a connection, which would be unfortunate."

The uranium counterweights are used in the control surfaces of the aircraft, including the rudder and elevators, where space is limited and dense material is required.

The depleted uranium used is a by-product of natural uranium used in reactors. It was sold by the U.S. government cheaply in 1980.

"They were trying to think of ways to use it and they really did not explore the public issue of health and safety sufficiently," said Dr Parker in an article first prepared some time before the Lockerbie disaster.

He estimated that a jumbo jet could contain 1,000 pounds of depleted uranium which is "not without its hazards."

It is chemically toxic, slightly radioactive and, in certain forms, is classified as a fire hazard because it spontaneously combusts on exposure to air.

In particular, he was concerned by the consequences of a severe fire on a jumbo jet. The consequent release of airborne uranium oxide particles presents a hazard.

"I calculate that about 250,000 people at worst could be put at risk from the 1,000 pounds of depleted uranium in a Boeing 747," he said.

Commenting on the Lockerbie disaster, he said early accounts suggested the aircraft blew apart in the air so "it

seems to me that kind of a crash is probably not the kind that is likely to expose the uranium in the tail to the prolonged heat necessary to cause it to ignite, oxidise and burn."

He said the Nature article was originally written a year ago and had been seen by Boeing, "who said that of the 700 jumbo jets they had built, about 550 had the uranium."



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